SER. II. VOL. 22 NO. 8

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SER. II, VOL. 22 *June 1960* NO. 8

TRANSACTIONS
OF
THE NEW YORK ACADEMY OF SCIENCES

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Transactions of The New York Academy of Sciences, Series II, Volume 22, No. 8
June 1960

Second-class postage paid at New York, N.Y. This publication is distributed to members and is published monthly from November to June, inclusive, by The New York Academy of Sciences, 2 East Sixty-third Street, New York 21, N.Y.

Executive Director: EUNICE THOMAS MINER

SECTION OF GEOLOGICAL SCIENCES

LATE MESOZOIC AND CENOZOIC EVENTS IN NATAL, SOUTH AFRICA*

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University of Natal, Durban, South Africa

The Lebombo Basalt-"Rhyolite" Association

Karroo sedimentation ceased with the deposition of the Cave Sandstone, an essentially aeolian formation containing fossil wood and both invertebrate and vertebrate remains of early Liassic age at the latest. During the latter part of Cave Sandstone deposition, volcanoes broke forth from time to time and ash beds, often of great thickness, with associated agglomerates were also formed. At first the central type of volcanic activity alternated with ash beds; then a great thickness of harder compact and softer amygdaloidal flows poured out over a vast portion of southern Africa from which subsequent earth movement and erosion removed great volumes of the lavas.

In the Drakensberg area of Natal and Basutoland shown in FIGURE 1, the steep east-facing escarpment reaching more than 10,000 feet above sea level has at least 4500 feet of lava flows above the Karroo sediments. Much of the basalt is typical plateau basalt type, but there are variations from oceanite or limburgite to trachyte.

It is certain that many of the dykes of dolerite now exposed in the formations underlying the Karroo basalts were the feeders for the lava flows. There is an almost perfect identity in composition between the average basalt and dolerite, and even the coarser-grained lavas have a mineral composition and texture similar to those of the dolerites (see TABLE 1).

As the pile of basalt flows increased, the magma was prevented from reaching the surface through dykes, and so most of it was then forced into the almost horizontal laminated sediments below the lava flows as inclined or sill-like bodies that were intruded successively downward in the strata.

Just under 200 miles to the east of Mont aux Sources (one of the highest areas along the eastern escarpment of the Basutoland-Natal mass) near the Zululand coast is the south outcrop of a vast exposure

* This paper, illustrated with slides, was presented at a meeting of the Section on May 9, 1960.

The Section of Chemical Sciences held a meeting on May 3, 1960 at which F. M. Beringer of Brooklyn Polytechnic Institute, Brooklyn, N. Y., presented a paper entitled "New Chemistry of Iodonium Salts." This paper will be published by the Academy in a subsequent issue of the *Transactions*.

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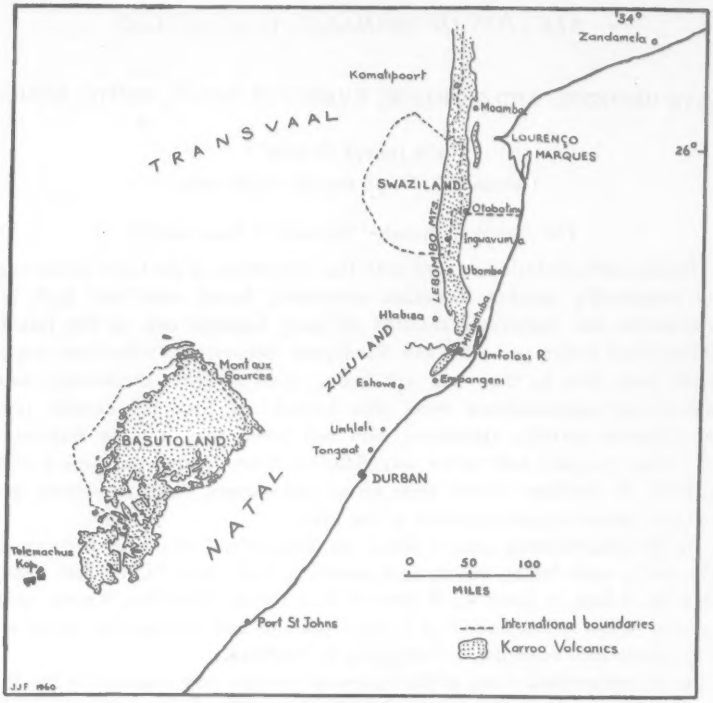

FIGURE 1. Localities sketch map.

of Karroo volcanics that trends north and forms both geographical and political boundaries between the High Commission Territory of Swaziland, Transvaal Province, and Southern Rhodesia on the west, and Mozambique on the east. In this occurrence, probably the eastern limb of an early arch now eroded that extended from the Drakensberg area, the deeply weathered basalts (about 4500 ft. thick) generally occupy lower-lying ground with occasional residual conical hills. A succession of younger volcanics less basic and more resistant to erosion forms the Lebombo Range, through which eastward-flowing rivers have cut deep gorges. This sequence is said to be 15,000 feet thick. Above this lie successively the Impamputo basalt, rhyolite of the Little Lebombo, Movene basalt, and some alkaline rocks occupying about 10,000 feet.

Unlike the lavas in the Basutoland region, the formation from Empangeni northward into the Lebombo mountains and beyond dips eastward. From the contacts of individual flows and lines of amygdales dips up to 35° have been measured. The basalts are similar to those of Basutoland. They are, however, covered by a very thick assemblage of reddish or brick-colored agglomerates, tuffs of various kinds and

TABLE 1

	Karroo basalt *	*Av. Karroo dolerite* †
SiO_2	51.32	52.5
TiO_2	0.96	1.0
Al_2O_3	16.48	15.4
Fe_2O_3	1.77	1.2
FeO	8.24	9.3
MnO	0.09	0.2
MgO	7.03	7.1
CaO	10.58	10.3
Na_2O	2.23	2.1
K_2O	0.65	0.8
H_2O+	0.67	-
H_2O-	0.10	-
Cr_2O_3	0.02	-
S	0.09	-
P_2O_5	0.13	0.1
	100.36	
Less O=S	0.04	
	100.32	100.0

* From southwest side of Modderfontein volcanic neck, Telemachus Kop, near Jamestown, Cape Province, South Africa. New Analysis by J. J. Frankel.

† Average Karroo dolerite (to water-free basis). From Walker & Poldervaart, 1949.

colors, black to dark green pitchstones, and some possible lava flows of intermediate composition. All these types have long been collectively called Lebombo rhyolites; yet true lava flows seem subordinate.

Typical analyses by some of my students are given in TABLE 2.

Also associated with these volcanics in Swaziland are a number of elongated bodies of younger pale-colored granophyres. In southern Swaziland there is a great concentration of north to south dolerite dykes that cut Karroo sediments, basalts, and the rhyolites. From the disposition of these dykes it may clearly be seen that they were formed over a period of time from the initial outpourings of basalt, when the earliest dykes were basalt feeders, through the volcanic period until the early Jurassic downwarping of the continental margin and crustal-stretching caused numerous cracks along which the basic magma had easy access.

TABLE 2

	Grey-banded tuff *	*Pitchstone*†	*Brick-red, fine-grained tuff*‡
SiO_2	70.88	66.89	68.92
TiO_2	0.51	0.45	0.47
Al_2O_3	14.05	12.89	12.45
Fe_2O_3	2.52	4.30	3.53
FeO	1.77	2.20	3.35
MnO	0.06	0.04	0.09
MgO	0.21	0.12	0.35
CaO	1.36	2.16	2.19
Na_2O	2.89	3.26	n. d.
K_2O	3.98	2.90	4.21
H_2O+	1.22	3.56	0.90
H_2O-	0.12	none	0.10
Cr_2O_3	n. f.	n. f.	trace
BaO	0.06	0.13	0.14
P_2O_5	0.31	0.16	0.43
	99.94	99.06	-

* Moamba Quarry, Mozambique. New analysis by T. M. Fleming.

† Near Ingwavuma, Northern Natal. New analysis by J. F. Lambert.

‡ Komatipoort, near Transvaal-Mozambique border. New partial analysis by H. G. Thompson.

There has been much speculation concerning the origin of the rhyolitic rocks. Two main theories have been proposed: (1) the less basic rocks represent a differentiate from original parental basic magma, and (2) much of these rocks is remelted basement granite and granodiorite.

There are several objections to these theories. If they represent a differentiate, the great volume of rhyolite relative to that of basalt is out of proportion to the amount that could be derived from a parental basaltic magma. If they are essentially remelted basement extruded through the basalt sequence, a greater uniformity of the rock types might have been anticipated. Certainly with marginal downwarping of the eastern coastal areas, rising geoisotherms might have assisted in a mobilization of basement; yet comparative heavy accessory mineral studies in nearby basement and in the volcanics themselves, among other considerations, do not support this theory of origin.

From field evidence and extremely detailed thin-section studies V. and E. Gorsky suggest that the rhyolite group may well be a metasomatized portion of the basalt sequence. Agglomerates, tuffs, and lavas have been transformed through intermediate stages of leaching,

chloritization, uralitization, saussuritization, feldspathization, and silicification. Relict basaltic textures, ghosts of original feldspar (average An_{58}), and augitic pyroxene can be seen in thin sections but more strikingly in negative photomicrographs. Plagioclase laths, frequently from An_{20} to almost pure albite, and a clino-enstatite pyroxene clearly younger than the original minerals have developed.

My own polished-section studies on both basalts and rhyolites show that in these two rock "types," iron ores have similar grain sizes and size distribution, identical textures, and similar chemical compositions.

The Gorskys state that there is no typical composition of the rhyolites. The silica varies from 60 to 90 per cent. There is no mica (except perhaps for some secondary sericite), a mineral often found in acidic lavas. It is also possible to distinguish two main groups of these rhyolites: (1) rhyolites derived from pyroclastic material, and (2) rhyolites derived from the metasomatic alteration of basalts. The metasomatic changes and certain paragenetic relationships between the different rocks were observed not only in natural exposures along the Lebombo Range, but also in cores drilled through the sequence in the Pongolo River Gorge in Northern Zululand as well as from cores recovered by Mozambique Gulf Oil Company in deep-drilling to 6000 to 9000 feet below a cover of younger rocks at Zandamela.

It is therefore suggested that heated vapours or attenuated solutions of silica, iron, and potash compounds from depth could have modified parts of the basaltic sequence after its extrusion, but during the later downwarping.

Contaminated Dolerites

Over the past ten years I have traced and mapped a great number of sills that differ in mineralogical and chemical composition from the normal Karroo dolerite sills. They vary from 2 to 20 feet in thickness. They have been recognized northward from Durban for about 150 miles in the interior and along the beaches of Natal and Zululand. Thus far none of these bodies has been found west of a line running from Durban through Eshowe and Hlabisa in Zululand.

Field relationships show that these bodies are younger than normal Karroo dolerite, and they have been found intruded into all Karroo rocks from the Ecca sandstones to the basalts.

The fresh rock is gray-blue in color, fine to medium-grained, with scattered small quartz-calcite amygdales. Spheroidal or columnar jointing is expressed clearly on weathering. Most of the sills are margined by a dull purple, glassy layer along top and bottom contacts. Every sill contains inclusions of basement xenoliths, either coarse quartz schists or granitic gneiss, some of which are almost completely disintegrated and digested (FIGURE 2). In general the alkali feldspar in these xenoliths shows some reaction. Zircon grains similar to those in the xenoliths

FIGURE 2. Exposure of Effingham type of contaminated dolerite showing inclusions of basement rocks, Natal Coast.

have been recovered from these "dolerites." Typical analyses from widely spaced localites are given in TABLE 3.

Addition-subtraction diagrams using the chemical data show that these rocks could be derived from normal basaltic magma that has been contaminated by granitic material; the mineralogy also supports this possibility.

Although some variation in the amount of silica has been noted in this contaminated variety of dolerite now called the Effingham type, the maximum value is in the vicinity of 65 per cent. Mountain (1943, 1958) finds this to be true in other acidified dolerites that he has investigated. It seems likely that dolerite magma can digest only a certain quantity of acidic material completely. Reaction ceases when the amount of silica reaches about 65 per cent.

The downwarping of the coastal area of Natal and Zululand already mentioned may have enabled a residual amount of basaltic magma retained in crustal reservoirs and not yet injected into the overlying sediments to acquire additional energy. This retention would have allowed the magma to react with the reservoir walls and to be modified in composition. Undigested fragments of these walls were later carried up with the modified magma to higher levels.

The Base of the Lower Cretaceous in Zululand

Although some Lower Cretaceous continental sediments have been recorded from the northern coastal areas of Natal, the actual contact with the underlying rocks has been obscured or at best is poorly ex-

TABLE 3

	Durban, Natal *	*Tongaat, Natal* †
SiO_2	64.83	62.80
TiO_2	1.58	1.50
Al_2O_3	12.86	13.66
Fe_2O_3	1.48	2.14
FeO	6.72	8.21
MnO	0.15	0.16
MgO	1.54	1.37
CaO	2.14	5.11
Na_2O	2.55	1.59
K_2O	2.68	1.64
H_2O+	2.39	0.84
H_2O-	0.24	0.12
BaO	0.17	n. d.
S	0.30	n. d.
P_2O_5	0.27	0.24
	99.90	
Less O=S	0.15	
	99.75	99.38

*Representative sample of contaminated dolerite from Effingham Quarry, near Durban, Natal. New analysis by W. H. Herdsman.

†Contaminated dolerite from farm Groom near Tongaat, Natal. New analysis by B. E. Beater.

posed (Rennie, 1936). During the early part of 1959 fluviatile conglomerates and lacustrine sediments resting on tilted and eroded Karroo basalts were found outcropping along the north bank of the Umfolosi River south of the village of Mtubatuba in Zululand. Road and quarry excavations have exposed conglomerates composed of weathered basalt boulders and cobbles resting on fresher basalt bedrock. Much silicified wood is scattered throughout the sediments. Jammed between and around a horizon containing silicified trunks is a silty layer that has yielded fairly well-preserved plant fragments. The following tentative determinations have been made: *Sphenopteris* (cf. *S. fittoni*), *Cladophlebis browniana*, *Cladophlebis* (cf. *C. denticulata*), *Zamites rects*, *Zamites sp.* (FIGURE 3), and *Dictyozamites*. Preliminary investigation of the wood shows it to be gymnospermous.

The flora indicates that the rocks are of Wealden age (base of the Cretaceous), although several of the plants are also known from older

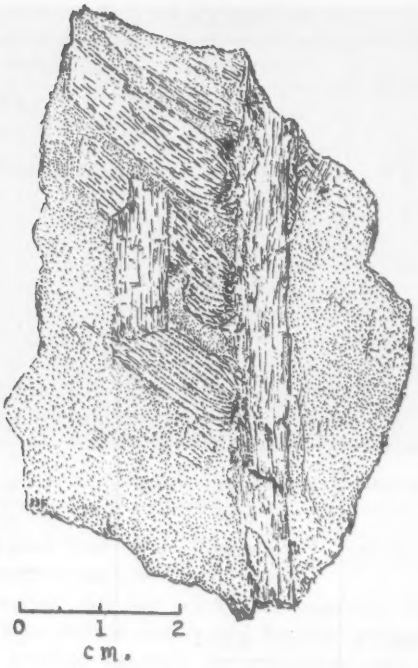

FIGURE 3. *Zamites sp.* from the Lower Cretaceous along the Umfolosi River near Mtubatuba, Zululand.

Jurassic strata. The type-area of Wealden flora in South Africa lies about 800 miles to the southeast near the coast at Port Elizabeth, while the nearest occurrence of similar rocks and plants is almost 400 miles to the southeast along the coast at Port St. Johns.

The Tertiary in Zululand

William Anderson, indicated in several reports the likely presence of Tertiary rocks along the Natal and Zululand coasts (Anderson, 1907). Much of the coastal plain of Zululand is covered by Quaternary and Recent sands and sand dunes, thus obscuring the underlying geology. The possibility that large areas of Tertiary rocks do exist beneath the sands is strengthened by the observations made by S. H. Haughton (personal communication) along the Pongola River near Otobotini in northern Zululand that shelly grits contain *Balanus* and lamellibranchs, and by later discoveries of Miocene marine sediments along the Umfolosi River. In 1952 I was shown some large teeth of *Carcharodon* from Uloa on the Umfolosi River. The faunal assemblage with which these teeth were

associated was subsequently described by King (1953) as Burdigalian or early Miocene, and Biesiot (1957) confirmed this age from a study of the Foraminifera.

Recently on Umkwelane Hill about 8 miles further inland from Uloa, also along the Umfolosi River, I discovered a further outlier of foraminiferal-bearing limestones rather more extensive in area than that recorded earlier. These limestones overlie Upper Cretaceous sediments that make up the lower part of the hill.

The Foraminifera are being investigated by J. St. Jean, Jr., of the University of North Carolina, who reports that some of the more common elements of the fauna resemble a Miocene occurrence described from Mozambique to the north, but that there is little resemblance to the assemblage recorded by Biesiot from Uloa 8 miles to the east. The difference is probably due in part to environment, for the Uloa fauna contains pelagic and benthonic forms while the Umkwelane assemblage is benthonic only.

It seems probable therefore that Tertiary deposits are indeed widespread along the Zululand coast. Detailed and careful mapping may yet fill in the stratigraphic gaps between the uppermost Cretaceous and the known Miocene, as well as that between the Miocene sediments and the limestones and red sands of Quaternary age.

Quaternary Ilmenite-bearing Red Coastal Sands

From the vicinity of East London to the Zululand-Mozambique border and beyond, bush and grass-covered intermittent ridges of fixed sand dunes roughly parallel to the coast cover the older rocks. The belt varies from a few tens of yards to four miles or so in width, and the undulating ridges rise in places to almost 500 feet above sea level; the average height is, however, considerably less. The dunes may slope directly onto a rocky beach, but in general they are separated from the sea by white or light cream recent dunes and beach sands.

The sands vary in color at surface from place to place and range through white, grey, creamy to deep red, or chocolate brown. They hold varying amounts of minor, resistant, heavy minerals such as ilmenite, zircon, magnetite, pink garnet, leucoxene, and monazite.

The sands must be regarded as Pleistocene to Recent in age, for they rest on rocks ranging from Archean basement to the Pleistocene consolidated Bluff-beds and gravels. Pre-Stellenbosch (Pre-Chellean) "pebble-type" artifacts have been found at the base of the sands and within the dune itself at a locality south of Durban, while Upper Stellenbosch (Acheulian) tools have been found on the contact between red sands and recent white sand dunes near the Tugela River mouth.

Drillings made in several places have revealed that the surface upon which the sands rest is undulating along the coast with gentle

seaward slope. The sands rest on boulder beds in several places; there is no evidence that the dunes and ridges are molded upon a core of harder older rock.

On surface the sands appear structureless, but here and there occasional thin layers of heavy mineral concentrations (cf. black sands) are seen. In artificial exposures and cuts there is frequently observed typical aeolian cross bedding in which there are alternating thin layers of light and heavy minerals, dipping at angles up to 30 to 35° and identical to the cross-bedding seen in the more recent beach dunes.

The color of the sands is due to some hydrated iron oxide in the thin coatings of kaolinite on the sand grains. This coating also acts as a cement that makes the dunes more coherent than the younger light colored sands. The thin cementing film is absent from the sands in several areas as, for example, Morgan Bay and the northern Zululand coast where the dunes are light colored and less coherent.

A conspicuous alternation of more or less horizontal red and yellow to white layers of varying thickness is seen on gulley walls or artificial cuts in the sands. While there is no regularity in the thickness of the layers, the red seem to be thinner (½ to 1½ inches across) than the lighter colored sands that may be 2 to 2½ inches thick.

The attitude of the layers is not dependent upon the hill or dune surface nor is it controlled by cross-bedding. Grading analyses show that, apart from a high percentage of iron-stained kaolinite cement in the red layers, the size distribution of the +200 mesh fraction and the heavy mineral contents are sensibly the same in both types of layer. It seems that the layering is due to a rhythmic migration of clay particles through the sands (cf. Brewer and Haldane, 1957) as shown in FIGURE 4.

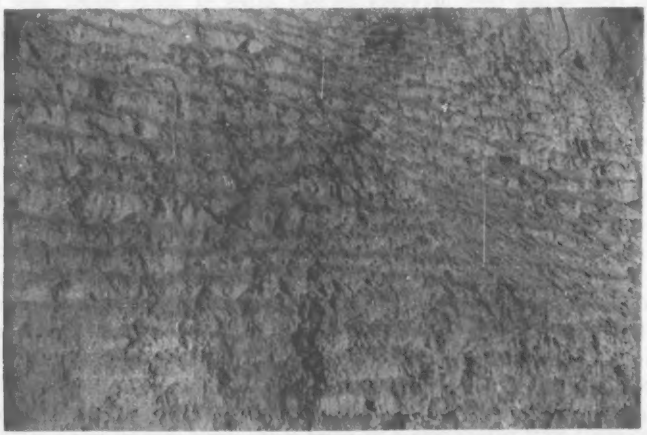

FIGURE 4. Alternations of red and lighter colored layers in coastal sands, Durban, Natal. Height at left-hand side is approximately 4 ft.

The dominant constituent of the sands is quartz in rounded to sub-angular grains varying in diameter from 0.05 to 0.7 mm.; but averaging 0.15 to 0.25 mm. Lesser amounts of feldspar and of shell fragments are present at times. The grading of the sands varies, but there is similarity between sands from different localities. Typical analyses are as follows (TABLE 4).

TABLE 4

GRADING ANALYSIS*

Tyler sieves	*Av. of red sands* †	*Red sands* ‡	*Cream sands* §
−14 +28 mesh	-	1.0	0.2
−28 +48	6.9	27.0	0.8
−48 +100	62.2	64.2	74.0
−100 +200	23.2	7.8	24.0
−200	7.7		1.0
	100.0	100.0	100.0

* By J. J. Frankel.

† Umgababa, South Coast, Natal.

‡ North of Umhlali River mouth, North Coast, Natal.

§ Morgan Bay, Eastern Cape Province.

There are variations in the heavy mineral content from place to place and within the dunes. The heavy minerals account for 2 to 25 per cent of the sands, but the average is about 7 to 10 per cent over a whole dune. The composition of the heavy concentrate generally lies within the limits indicated in TABLE 5.

TABLE 5

AVERAGE VALUES OF GRAIN COUNTS*

Ilmenite	70 to 80 %
Leucoxene	2 to 5 %
Rutile	2 to 5 %
Magnetite	2 to 8 %
Zircon	8 to 10 %
Monazite	trace to 0.3 %
Garnet, pyroxene, etc.	1 to 5 %

* By J. J. Frankel and others.

The economic interest in the sands centers therefore on the ilmenite, rutile, and zircon. In certain localities leucoxene and monazite may be important.

Typical cleaned ilmenite and mixed zircon-rutile concentrates from the Umgababa area, south of Durban, have gradings shown in TABLE 6.

TABLE 6

GRADING ANALYSIS*

Tyler sieves	*Cleaned ilmenite concentrate*	*Mixed zircon-rutile concentrate*
−28 +48 mesh	trace	-
−48 +100	15.3	9
−100 +200	82.3	89
−200	2.4	2
	100.0	100

*By J. J. Frankel

The average size of the rounded to subangular quartz grains would support an aeolian origin. It is suggested that the red sands were formed during the time of the Pleistocene glaciation of the Northern Hemisphere. During the periods of lowering of the sea level, broad belts of sea sand along the coasts were exposed to wind action and in this way high dunes were formed. Whether they were originally barchans or longitudinal dunes we do not know as the original profiles have long since been modified. Detailed studies of cross bedding might assist (Shotton, 1956).

The various minerals that make up the sands can be traced to all the geological formations in the hinterland. The quartz, potassic feldspars, rutile, garnet, zircon, and tourmaline, for example, derive from granitic basement, pegmatites, and all the younger sediments. The ilmenite has come from a variety of rocks ranging from basement to the Karroo basalts and dolerites.

The source of the magnetite seems to be Karroo basalts and dolerites rather than older formations. Polished section studies show that the magnetite from the sands and the Karroo igneous rocks hold much ilmenite lamellae unlike that from the older rocks. Chemical analysis of the weakly hand-magnetic fractions from the sands gives 17 to 24 per cent of titania, from basalts, rhyolites, and dolerites 9 to 34 per cent. Magnetite separated from basement granites and amphibolites holds 3.2 to 3.4 per cent titania.

Little plagioclase has been identified in the red sands that also seem to have less pyroxene than the present day beach sands. It is suggested that the iron hydrate-kaolinitic cement in the red sands is derived from the weathering of plagioclase and some ferromagnesian minerals under subtropical conditions after the initial formation of the dunes. Support for this suggestion comes from studies made on thoroughly weathered dolerite dykes near the coast where all that is left of the

original rock is a red iron hydrate-kaolinitic association throughout which somewhat weathered magnetite and also ilmenite are distributed. The kaolinitic materials from the sands and from the weathered dolerites give identical X-ray and D. T. A. patterns.

Previously, all authors had considered that the decomposition of ilmenite and magnetite supplied the pigmenting material in the coastal sands; this does not appear to be so from the results of the present investigations.

Summary

The Lebombo basalt-rhyolite association and late Karroo contaminated dolerites have been discussed. Silicified wood and other plant remains have established the lower Cretaceous age of a continental sequence resting on tilted and eroded Karroo basalts in Zululand. A new occurrence of Miocene sediments points to the possibility of a wider distribution of Tertiary rocks in Zululand than has been previously recognized. The distribution of Quaternary ilmenite-bearing red coastal sands has been described and an aeolian origin suggested.

Acknowledgment

I am grateful to V. and E. Gorsky of the Comissão Nacional de Energia Nuclear, Rio de Janeiro, Brazil, for the information they furnished me based on their exhaustive and detailed studies of the Lebombo rocks.

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THE PSYCHOPROPHYLACTIC PREPARATION OF PREGNANT WOMEN FOR CHILDBIRTH IN THE UNION OF SOVIET SOCIALIST REPUBLICS*

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Directives from the Ministry of Health and from A. A. Terekhova, chief obstetrician advising that body, decisions made at the famous Kiev Conference of February 1956, and observations made in the laboratories of the historic I. P. Pavlov Physiological Institute at Leningrad have resulted in adoption of the "psychoprophylactic method" by the therapeutist, or general practitioner, in Soviet polyclinics. The method has been applied to 87 per cent of parturients in that country. The chief objective of the method and of the directives from the ministry is that each mother will go through her pregnancy "charged with assurance" at every step. Organization at the highest levels for this treatment, the training of obstetricians, the research into pregnancy and its many facets, the training and the use of midwives, the inculcation of the objectives of the program in nurses, technicians, and ancillary personnel place the mother during her first interview and subsequent antepartum care among people exuding confidence.

The Great Plan of the Soviet Union[1] for the next seven years outlines the objectives of the government for general medical care. While no detailed breakdown of statistics has been given, I presume that maternal and infant care would be scheduled for approximately 12.8 per cent, based on the proportion allocated in the budget for the last Five Year Plan.

The psychoprophylactic method really starts at the future mother's place of employment where she is told that she will have full pay during her confinement, and this in turn starts in motion the virtual hypnotization that decreases or may eliminate entirely the common anxieties and fears of pregnancy and creates a feeling of the utmost security. A mother may elect to have her infant without training in the method, but in a regimented society each citizen tends to do as others do.

Soviet obstetricians will flatly deny that their method of conditioning for childbirth is based on the principle of hypnosis. However, doctors have utilized principles of hypnosis for the relief of pain ever since the earliest concepts of mesmerism in the 18th century began evolving into into the science and practice of hypnosis and suggestion. An experienced observer will recognize that an hypnoidal state is induced during the

*This paper was presented at a meeting of the Section on May 9, 1960.

indoctrination of a group of three or four mothers. Chertok and Bonstein[2,3] have written on the method and its variations from the professional viewpoint. Karmel[4] has noted the reactions of patients with the advantage of personal experience. In these texts the element of suggestion is apparent.

I watched a young but obviously competent and confident obstetrician trained by Alexander Michailovich Kagansky in the October Ninth Revolution Hospital in Kiev demonstrate a lesson in the psychoprophylactic method. My impression was that they selected their most promising young obstetricians and gynecologists to conduct the initial sessions. After five minutes the doctor had his three subjects so deeply absorbed in his instruction that they seemed unaware of the presence of cameras and floodlights. His manner and voice were those of an experienced hypnotist. The appearances of his patients were those of persons in a state of light hypnosis. The total picture was one of confidence and repose.

To understand the Russian method and its success it must be appreciated how deeply Pavlov's teachings[5,6] pervade all aspects of Soviet medicine. For the moment, let us grant their contention that their method is not group hypnosis but something else. What is this something else? The something else is a detailed assurance of the parturient with techniques based on the second signaling system of Pavlov. During five antepartum sessions near term the patient is taught rhythmic breathing, controlled relaxation, contraction of the muscles of the pelvic floor, a manner of stroking the abdomen, and the application of pressure to the anterior superior iliac spines and, in the back, to the sacroiliac region. Simultaneously it is suggested to her, and repeated continually, that that these exercises will flood the cortex and, specifically, the pain centers with so many impulses that they will crowd out any appreciation of pain from the uterus. Since every Soviet citizen has known the name of Pavlov since childhood, even if not his theories, this suggestion enables the obstetrician and ancillary personnel to indoctrinate the parturient with something positive to combat any fear she may have about labor and the delivery. Birynkov and Karanian[7,8] have written articles that are summations of Pavlov's theories and indicate the basic principles involved in signalization that make it possible to condition mothers.

Psychologists studying the reaction of fear emphasize the fact that fear can be magnified when the patient is alone in the face of danger. In the psychoprophylactic method, this fear is combatted in two ways. First, the system of midwifery permits an experienced person to be with each continuously. Second, patients labor in groups, at least in the larger centers where the number of deliveries each day makes this feasible. This establishes a camaraderie and togetherness that is inevitably comforting to women in labor. Women about to deliver are moved into the delivery room together and may watch their friends in labor deliver their infants while awaiting their great moment.

What is the future of the psychoprophylactic method? What research is

being done or contemplated to improve the technique? How will Soviet women, more and more enlightened as to the ways of women in the western world, adapt themselves to this method of management of a primitive function? O. L. Nemtsova and her associates in the Physiological Laboratory of the Ministry of Public Health of the Union of Soviet Socialist Republics, Moscow, have published an article characteristic of their attitudes and thinking. Their paper reports the results of experiments by the usual Pavlovian techniques on pregnant dogs that have been classified into Pavlov's four personality types: phlegmatic, sanguine, choleric, and melancholic. Attempts were made to predict the reaction of bitches in labor; this could be done with reasonable accuracy. In the very same laboratory elaborate arrangements were made to study pregnant women by both the first and second signaling systems. From a perusal of the records and extent of the files, I estimate that they must have already studied many hundreds of women in a variety of experiments dealing with preparation, labor, and delivery. The method will continue as a basic concept in Soviet obstetrics with refinements to be expected.

Summary

The psychoprophylactic method of preparation of pregnant women for women for childbirth based on conditioning patients by Pavlov's second signaling system is an effective means of controlling the pain of labor, particularly where groups of three or more women labor and deliver together.

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IMPRESSIONS OF SOVIET SURGERY*

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Prior arrangements for the tour had been made with the Soviet Ministry of Health by The World Medical Association Travel Department. In Kiev the visitors and I were taken to the October 9th Hospital and introduced to Leonid Georgeonovich Ostrachan, the hospital's administrator, who welcomed us warmly and placed his aides at our service. Following a brief question and answer period about the institution, those interested in surgery were guided to the office of Michael Isodorovich Kolomirchenko, the chief surgeon, who had arrived from his dacha that morning especially to greet the group. Ward rounds were conducted, and many surgical problems common to both Soviet and United States doctors were discussed. Small cots had been placed close together, as apparently Soviet hospitals also have a shortage of hospital bed space.

The following day we again visited the institution. We separated into small groups, and two of us observed the orthopedic section that consisted of 65 beds devoted to joint and bone tuberculosis. We were introduced to the assistant director, who proceeded to describe the methods of diagnosis, describing in detail a method attributed to the Chinese. The procedure involves the use of an electrical machine with an indicator that oscillates as the needle held in the technician's hand touches the skin adjacent to an abnormal joint. The site of reaction is marked on the skin by a stain. The milliampere machine is made in East Germany and is said to be accurate for diagnosis of joint tuberculosis. In answer to a question, "Do you use X rays for the diagnosis?" the answer was, "Yes"; but when we asked to see the X-ray machine, our request was ignored.

We later saw the milliampere machine in use. We were asked if in the United States there were many cases of joint and bone tuberculosis, and we replied negatively, explaining that we have a nationwide program of prevention. One of the visiting doctors asked if the Soviets had a program of prevention, and the interpreter replied that it was an embarrassing question as they had no such program.

The principal method of treatment there is rest and PAS. A new treatment under experimentation consists of taking several hundred cubic centimeters of blood from the patient, then re-injecting it into the same patient subcutaneously. Several days later the skin and involved underlying tissue are excised and quartered, made into a solution, and injected into the fascia. The objective is to stimulate immunity. The method is too new for conclusions to be adduced. The investigators report no complications.

The following day we returned to the hospital and I was accorded the opportunity of assisting Kolomirchenko operate for a chronic peptic ulcer.

*This paper was the second of three papers presented at a meeting of the Section on May 9, 1960.

A subtotal gastrectomy was done with local anesthesia, one fourth of 1 per cent novocain in large amounts. The skin was infiltrated, and the incision was made in one stroke through the entire thickness of the abdominal wall including the peritoneum. No bleeding vessels were ligated. A large Kocher-type instrument grasped the peritoneum and overlying clamped sterile towels, transfixing the margins of the incision. This procedure controlled the bleeding vessels. Additional procaine was infiltrated around the celiac ganglion and vagus nerves, and the operation proceeded rapidly. Thirty minutes later a large section of the stomach had been removed and the duodenal stump closed. The gastroenterostomy was performed antecolic, and just distally an enteroenterostomy was also performed. One size suture was used throughout. Soviet physicians do not perform the meticulous layer-by-layer anastamosis that surgeons are taught to do in the United States. Serosa, muscularis, and mucosa are included in one "baseball" type of suture without making any attempt to ligate individual vessels. No nasogastric tube was used to keep the stomach deflated but, just before completing the gastroenterostomy, a large "potato masher" type of suction was placed into the severed stomach and the stomach contents aspirated. The first assistant assumed completion of the operation and, between the patient's groans, the incision in the abdominal wall was closed.

After our arrival in Moscow we were taken to the Yudin Institute or the Skeifasovsky Hospital. We donned white coats, were ushered into the auditorium, and listened to a brief report of the institution and its objectives by the director, Mikhail M. Tarasov. People accidentally killed or suddenly dying on the Moscow streets and emergency cases are brought to the institution. It is from this type of case that cadaver blood is drained for subsequent transfusion to the living. When the body is brought in, it is immediately taken to a special room and placed on a table that can be tilted to an exaggerated Trendelenburg position. All visitors must be gowned and masked. The corpse is wrapped in sterile sheets and, observing aseptic technique, an incision is made in the neck, the internal jugular vein is isolated and opened, and glass tubes are inserted, a curved one directed toward the head and a straight one toward the trunk. The glass tubes are connected by rubber tubes to sterile receptacles. A solution is used to perfuse the veins in order to recover as much blood as possible (TABLE 1). Six to eight liters are usually recovered. Following this procedure, an autopsy is done, and the blood from those cadavers with infection such as tuberculosis, syphilis, and cancer is discarded. Tests are made for contaminants. The blood is kept 4 to 6 weeks at 5° C. Tarasov said that it is better than fresh blood because it does not clot, and the anticoagulant citrate is not used. This is the only institution where cadaver blood is used for transfusion.

Use of such blood came about as follows: an engineer attempted suicide by cutting a major artery and was brought to the hospital exangui-

nated. No fresh blood was available. Accordingly, the late Sergi Yudin, then chief surgeon of the institution, having previously used cadaver blood on dogs without reaction, decided to use it on the engineer and the man recovered. This transfusion occurred on March 30, 1930. Cadaver blood has been used continuously in the Yudin Institute but in no other hospital in the Soviet Union. The red blood cells carry oxygen as does fresh blood, but it undergoes fibrinolysis and does not clot. Tarasov said 60,000 transfusions have been given since the first one without one adverse reaction having occurred.

TABLE 1

SOLUTION USED TO PERFUSE BLOOD FROM CAPILLARIES AT THE YUDIN INSTITUTE

Glucose	30.0
Natural phosphoric	15.0
Natural sulfacil	5.0
Chloromycetin	0.1
Aq. distillata q. d.	1000.0

Later we were introduced to Pavel Androsov, the chief surgeon, a dynamic person with quick bright eyes and movements that indicate unlimited enthusiasm and energy. I was given the opportunity of assisting him in operating on a case of colon substitution for stricture of the esophagus. Two to three operations for this condition are performed each week as cases from the entire Soviet Union with the problem are funneled into this hospital. Children, especially, accidentally drink cleaning fluid such as lye that, if they survive, results in extensive scarring and stricture of the esophagus and often the pyloric end of the stomach. Yudin devised the operation first using a section of ileum, but the ileum's lack of resistance resulted in ulcers and perforation (we saw one such case). Later, ascending and proximal transverse colon were used and have proved satisfactory. Since Yudin's death his method has been followed by his successor, Androsov. This surgeon is a master technician – rapid, sure, and accurate. Once the cecum and ascending and proximal transverse colon were released from their lateral peritoneal attachments with the blood supply intact, the terminal ileum was transected, and incision was made in the neck to the left of the trachea. Using blunt finger dissection to the left of the sternum, the parietal pleura was pushed from the under-rib cage, and the colon, with attached distal ileum, was brought extrapleural beneath the ribs and sutured into the neck incision. Three days later the ileum was to be sutured to the esophagus. Previously, the surgeon had anastamosed the severed distal ileum to the remaining transverse colon, and the end of the proximal transverse colon to the cardiac

end of the stomach. The entire procedure required only 45 minutes. The meticulous details observed in our large hospitals were not scrupulously followed. One size suture was used throughout, without layer-to-layer anastamosis. Androsov is a master in his field, a bold and exceptionally adroit surgeon and a superb anatomist.

The second case was a subtotal gastrectomy with use of their special instrument for anastamosis. This instrument is a modification of the von Petz clamp and uses small tantalum staples with the suture line turned in. The smaller one is cleverly designed for arterial anastamosis. The staples are very small and are placed in the instrument one by one by a nurse. Nurses are unlimited in numbers, as is other professional personnel. In this respect the Soviets are far ahead of us.

Our hosts treated us warmly and royally, offering us every consideration possible including delicious refreshments after each operation. They frequently ask, "How do we compare with surgery in America?" They are anxious that we approve their efforts. They are clever, intelligent, and able.

The next day we returned to the institute and observed the same surgeon remove the entire stomach for carcinoma. This was done through the abdominal approach. The surgeon then substituted about 4 in. of transverse colon for the excised stomach. The distal section anastomosed to to the esophagus, the proximal end to the duodenum.

Between operations we observed the chief surgeon of the Soviet Navy perform an esophagoscopy, removing a fish bone from a patient lying on her abdomen and supported by her elbows. This was done expertly in a few minutes, without anesthesia and with a few patient groans. The people are stoics because they have had to learn complete acceptance.

We were privileged to observe the top echelon of Soviet medicine at work. These functionaries are capable, of great intelligence, and well-informed on all medical advances and progress. We can learn from them and they from us, and I hope there will be more exchange of visits between our peoples.

MEDICINE AND PSYCHIATRY IN THE UNION OF SOVIET SOCIALIST REPUBLICS *

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The discovery of the unconscious and its profound effects on the mental and physical functioning of man is considered perhaps the greatest contribution psychology has made to medicine in the first half of this century. Indeed, the majority of researchers in the United States and other countries of the Western World consider the vast quantity of mental life that at one time had been conscious and then became repressed or that never reached consciousness to have a more powerful effect on the psychodynamic functioning than the conscious mind.

Soviet medicine rejects the concept of the unconscious as it does the Freudian or any related school of psychoanalysis. In Kiev, the first stop of an inspection tour members of the United States Committee of the World Medical Association made during August 1959 through the Soviet Union and Czechoslavkia, I raised the question about psychotherapy at the Neurological Clinic of the October Ninth Hospital. The thousand-bed mental hospital called the Pavlov Institute could not be visited at that time because of repairs. It was difficult to obtain a clear picture of what was being called psychotherapy as indicated by the following question and answer period:

Q. "Do you use psychotherapy?"
A. "We talk to the patients when necessary."
Q. "For how long?"
A. "That depends."
Q. "Do you talk for an hour?"
A. "Not that long."
Q. "For ten minutes?"
A. "Longer than that if necessary."

A much firmer rejection of the psychodynamic point of view came in Leningrad. We were authoritatively informed at the Bechterev Hospital that psychoanalysis was not practiced there, because, as it was put, "We are not sure that Freud was correct." Lobotomy and insulin therapy also were not practiced at the hospital. Electric shock therapy was used less frequently, tranquilizers and sleep therapy now being preferred.

The theoretical basis of Soviet psychiatry, as well as the treatment for mental, nervous, and many physical disorders such as essential hypertension, is based on Ivan Pavlov's work at Koltushi, a small village of scientists about 20 miles north of Leningrad. There Pavlov had studied different types of behavior and features of inheritance. During World War II the Germans occupied Koltushi and killed all animals, among

* This paper, illustrated with motion pictures and slides, was the third of three papers presented at a meeting of the Section on May 9, 1960.

them many generations of conditioned dogs used for the study of genetics. Now new generations of conditioned dogs are being bred in order to resume the study on behavior and genetics. Four of our group were privileged to visit several laboratories at Koltushi where we could see not only various types of decorticated dogs but also an immense program of reconstruction.

The Pavlov Institute consists of a theoretical division in Leningrad and the experimental institute with about 20 laboratories in Koltushi.

One of the laboratories dealing with oncology studied the different development of malignant tumors in rabbits with different types of nervous systems. V. Fedorov pointed out that the cause of artificially produced malignant tumors was found to be the same in most animals with an identical course of conditioned activity. Malignant growth developed rapidly and soon resulted in the death of rabbits of equilibrated, mobile nervous processes and in those classified as a group of inhibitory animals. A slow and prolonged cause of disease was observed in excitatory, inert animals. To my question as to whether "depressed and hopeless" animals were more prone to cancer or showed a greater progress of the disease, Fedorov answered with an emphatic affirmative.

Pavlov, after he had established differences of behavior due to environmental factors, turned in 1930 to psychiatry, publishing a paper called "Trial Excursion of a Physiologist in the Field of Psychiatry."* He demonstrated experimentally that the human organism as a whole, as well as all its parts, has tiny areas of representation in the cortex of the cerebral hemispheres. The higher functions, such as speech and thought, which exist only in man, Pavlov called the Second Signalling System. He explained the conditional reflex as an arc or a sort of short circuit in the cortex between the afferent centers and the tiny visceral representations in this multibillion mosaic structure of the brain.

The dynamic system of the cerebral cortex operates through a continuous interaction of excitation and inhibition. Psychic troubles are believed to result from a clashing of the forces of excitation and inhibition and the strength of such a collision. Pavlov and his school observed that when an overstimulation was strong enough to threaten the life of the cells, inhibitory processes of their function would take place in order to protect them from exhaustion or destruction. This reaction, called "protective inhibition," plays a most important role in Soviet psychiatry and forms the basis for the treatments of nervous, mental, and many physical diseases. Included in this therapy is a training of the inhibitions, psychotherapy and, lately, hypnotherapy, drugs, physiotherapy, medical physical culture, and protracted sleep. This

*From *Archives Internationale de Pharmodynamie et de Therapie*, 1930. This paper is the raison d'être of Pavlov's study of psychiatry. It describes manifestations of sleep and hypnosis noted in psychiatric patients, especially schizophrenic but also in alchoholic patients, and best represents Pavlov's attitude toward patients.

latter therapy is induced by a machine and consists of a pair of electrodes placed over the eyes and the occipital area of the skull, through which a current of 127 v. and 10 to 25 ma. were given in 10 to 100 impulses per minute.

Among the methods of rehabilitation of patients, occupational therapy plays a primary part. At the Bechterev Hospital in Leningrad, we were greatly impressed by watching patients being trained in a variety of occupations. According to Pavlovian principles, the tasks of the patients are selected according to how ill they are: the sicker the patient, the simpler the task. As a patient improves, more complicated tasks are given to him until he completes a finished product symbolic of a process of integration as, for example, a fountain pen, which was given to us as a present. The working rooms at the Bechterev mental hospital looked very much like a small factory producing pajamas, underwear, belts, shoes, hammocks, TV antennas, and other items. There were tool-making shops and metal and wood shops. All the manufactured goods are useful products, and the emphasis is on helping the patients to return to a normal life. Schizophrenics worked together with epileptics and other neurological cases. Significantly, the patients, although ill, are being paid full salaries with pension rights; this is believed to restore in the patient self-respect and his sense of reality and usefulness.

The acute ward had glass windows without iron bars. The open side of this stairway was protected by ropes and hanging nets.

During the question and answer period we learned, among other pertinent facts, that homosexuality is considered a crime in the Soviet Union and is therefore punished. They had seen very few cases that were treated in "various ways" including insulin shock, but with no results. We were told that, due to the system of socialized medicine, there was practically no narcotic addiction in the Union of Soviet Socialist Republics, except for some cases in Central Asia. There was no literature about it.

Medical and psychiatric care in the Soviet Union is adequate and functions well. Most hospitals are old in structure and some of the equipment is, by United States standards, antiquated; other equipment, such as electroencephalographs, was modern. All the hospitals and wards we visited were immaculately clean, and almost all corridors had arrays of green plants. Most of the hospitals we visited had suffered heavily during the war and are being rebuilt and modernized.

The most amazing experience to this observer lay, however, outside the medical and psychiatric field and in what seems perhaps the most gigantic experiment ever conducted in the history of man: namely a mass application of the Pavlovian principle by a government to reshape the behavior of all its citizens. The very method Pavlov had used to produce an ideal type of a "strong, balanced, alert" dog is applied to condition the vast population of the Union of Soviet Socialist Republics in order

to achieve Pavlov's hope: "... the perfection of the human race of the future."

Whether this experiment will prove successful is perhaps for another generation to determine. As scientists, we must not concern ourselves with political doctrines but retain an open mind and examine without passion views and methods of others. As physicians, we can have but one common enemy and that is the suffering of man and his diseases— be they of body or mind – and in this battle we cannot afford to disregard ideas and discoveries of human minds regardless of political boundaries. The cordial reception our Soviet colleagues extended to us and their full cooperation in allowing us to examine facilities that had been closed for so many years were hopeful signs of a closer and more fruitful exchange of concepts toward our one mutual goal: a peaceful, healthier, and saner society of man.

THE NEW YORK ACADEMY OF SCIENCES

DIVISION OF PSYCHOLOGY

ARAB AND UNITED STATES CHILDREN: SOME PSYCHOLOGICAL COMPARISONS *

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Introduction

Recently I spent two years in the Middle East. A psychologist who finds himself among alien people naturally attempts to understand their values and their basic attitudes. By virtue of his professional background he is skeptical of the impressionistic approaches used by tourists, journalists and, sometimes, by social scientists. To his chagrin he soon learns that his own techniques are not adequate for the study of national character. The psychological methods with which he is familiar were devised in the United States for use there or in other western countries. When translated into the languages of nonwestern nations, they seem bizarre and inappropriate.

In the preceding paragraph I am not referring to the deficiencies of tests of abilities. The shortcomings of mental tests used crossculturally have become apparent. Here the concern is not with tests that attempt to be "culture-free" but rather with tests that will measure culture. In a broad sense, the aim is to compare the personalities that are produced in different cultures.

When an attempt is made to devise crosscultural techniques for personality research, the first impulse is likely to be to use nonverbal methods since languages vary from group to group. However the familiarity of people of different cultures with specific nonverbal materials and the significance to them of those nonverbal stimuli that are familiar also vary greatly.

On the other hand, generations of linguists and of polylinguistic speakers have established linguistic equivalents for many expressions. These equivalents are particularly successful when dealing with denotable objects and actions. For better or for worse, the use of language materials has been chosen. While no elaborate justification of the choice will be attempted here, experience indicates that the translation of

* This study was conducted during 1958 and 1959 when the author was on leave from Brooklyn College and served as a visiting professor at the American University of Beirut, Lebanon. The work described in this article was supported in part by a grant from the Rockefeller Brothers Fund, New York, N.Y. to the American University of Beirut and by a grant to the author from the Social Science Research Council, New York, N.Y.

This paper, illustrated with slides, was presented at a meeting of the Division on May 16, 1960.

The Division of Instrumentation held a meeting on May 10, 1960, at which Alonzo R. Parsons of the Minneapolis-Honeywell Regulator Company, Long Island City, N. Y., presented a paper on "A Giant Step Forward in Oscillography." This paper will be published in the *Annals* of the Academy.

simple questions about objects and actions from English into several languages is feasible, a proposition that few linguists will challenge.

In accordance with the rationale briefly indicated above, an attempt has been made to formulate a number of open-ended questions intended to explore psychological differences between groups and designed to have universal or quasi-universal applicability.

Before proceeding further, perhaps the aim to be achieved should be stated more clearly. I have tried to frame open-ended questions the answers to which would reveal some of the basic preoccupations, world-views, or values of any group.

In the attempt to devise a crosscultural set of questions, I have experimented with two interrogative forms. One of these is: "What is so-and-so for?" In the actual questions "so-and-so" becomes an object, such as a tree; an action, such as singing; a body part, such as the mouth; or a kind of person, such as a father. The assumption underlying the use of questions of this sort is that a group of respondents, in attributing uses, purposes, or functions to a number of referents, will reveal to a considerable extent the goals that they themselves customarily attempt to achieve.

The second kind of question is: "Why does a person so-and-so?" "So-and-so" here is a verb or verbal phrase referring to some common human action, such as running, shouting, or hitting someone. In this case the underlying assumption is that respondents will usually indicate what their motives would be if they were to perform such actions.

In order to make these questions universally applicable in the "uses" questions the referents employed were those that are universally present, including stars, fire, water, boy, girl, mother, and father, or referents that, if they are not universally present, are widely known, such as mountains and seas. Similarly, the questions concerning "motives" refer to actions performed in all societies, such as running, singing, shouting, and crying.

In addition to the principle of universal familiarity, several other requirements were kept in mind in formulating questions. One was simplicity of content. Only questions were retained that, on trial with several groups, proved to be comprehensible to 10-year-old school children and to adult illiterates.

A further principle was that questions must, in the course of preliminary use with several groups, yield a diversity of answers. It is obvious that if a question leads to a uniform response it is not useful in distinguishing between groups. For example, let us take the question: "What are the eyes for?" In every group with which we tried this question, the uniform answer was: "To see with." Because it yielded almost zero variability, it was rejected. In contrast, the question "What are the hands for?" resulted in diverse answers not only between groups but within each of several groups and therefore was retained.

As implied above, many questions were tried. In fact, a large part of the effort in connection with this project has gone into the construction and pretesting of questions. However, in order to make group comparisons, at a certain point the technique was temporarily frozen and data obtained that will be reported in later sections. This temporarily frozen test consisted of 70 questions.

Experience tends to indicate that, for questions of the types that were used, 70 is about as large a number as can be answered in one testing session without protest or fatigue. However, for future work some of the 70 that were used in the Middle East would be replaced with others that for various reasons now seem preferable. It must be stressed that what is proposed in this paper is a method of research, not a finished test. It is desirable to keep the list of questions flexible until many additional groups have been sampled.

Scoring Categories

Once answers are obtained to a considerable number of questions of the two types described, what is to be done with them? The simplest procedure would be to compare groups with regard to their responses to each question. This was done in an earlier study, but in that study only 16 questions were asked and only a few groups of subjects were used. With a larger number of questions and more groups this procedure becomes cumbersome. To solve these difficulties responses have been classified into categories and groups of subjects compared in regard to the number of answers falling into each category.

The possible number of categories into which the answers can be sorted is very large. After trying many classifications, I have chosen for the present paper to use a fourfold classification:

Benevolent. Responses referring to helping others, taking care of others, or referring to love, loyalty, affection, or friendship.

Malevolent. Responses referring to ill will, injury, or the threat of injury, whether by the respondent or by others. Included in this category are references to hitting, striking, fighting, fear, distrust, hatred, danger, disaster, and calamity.

Hedonistic. Responses referring to objects or actions as sources of pleasure or displeasure.

Religious. Responses referring to the deity or to religious books, religious leaders, and religious rules, practices, and prohibitions.

How these categories were used in scoring responses may be illustrated by considering answers to the question: "Why does a person run?" The answer "to help someone" is scored as benevolent; "because he hurt someone" is scored as malevolent, "because he is playing" is scored as hedonistic, and "because God does not like a lazy man" is classified as religious. "Because he has been sent on an errand" does not fall into any of the four categories and hence is not scored, although it could be scored if additional categories were employed.

Reliability

Before scoring the tests on which this report is based, a large number of responses were scored by two assistants. Their categorizations were compared, the differences discussed with the experimenter, and a uniform set of rules adopted. After this preliminary period, the proportion of answers categorized identically by the two scorers was approximately 80 per cent.

While the scoring agreement is gratifying, the test did not yield very reliable individual scores as measured by the split-half method or by test and retest correlations. This was expected, since 4 scores are derived from 70 items and only about 35 of the items contribute to these scores. Reliable individual scores cannot be derived from so small a sample of behavior.

However, the present technique was used for the study of group differences, and hence its reliability must be evaluated in terms of its ability to differentiate groups rather than to differentiate individuals.

In examining the stability of group averages, it proved fortunate that in the Middle Eastern sample there were no significant differences between boys and girls. We may therefore treat local groups of boys and girls as if they were two samples of the same neighborhood or same school and determine how stable the group scores are. Each local sex group contained approximately 25 subjects. There are 13 pairs of such groups, each yielding scores on 4 scales, and thus producing a total of 52 pairs of group values.

In the 52 comparisons of paired male-female groups, the median scores were identical in 21 instances, differed by 1 point in 20 cases, by 2 points in 9 cases, and by 3 points in 2 cases. No paired male and female medians differ by more than 3 points. The mean difference between paired medians in 52 comparisons was slightly less than 1 point. In other words, the average error of the medians was less than one. This would appear to be quite adequate evidence of group reliability since on some scales differences between nonpaired groups are as great as 12 points.

Validity

The question of validity, as usual, is a difficult one. There are no measures of concurrent validity. If there were independent indices of benevolence, malevolence, hedonism, and religion, it would not have been necessary to develop the test. It is hoped eventually to establish relationships between scores and other measures thus demonstrating construct validity, but such a task remains largely for the future. At present only tentative approaches to the problem of validity can be made, such as determining whether the differences in scores between Arab college students, who represent the most westernized Arab group,

and Bedouins, who are the least westernized, are what would be expected on the basis of available information about acculturation in the two groups. Data of this sort will be forthcoming in the course of the presentation of the findings.

Subjects

At this point, it must be confessed that the phrase "Arab and United States Children" in our title is somewhat misleading. The American subjects were children attending a school in Lebanon, specifically the American Community School in Beirut. They cannot be accepted as representing the United States as a whole, but they are typical of upper middle class American children. Since returning from Lebanon, the limited time, money, and energy available have not as yet made possible the gathering of more extensive American data.

Furthermore, in addition to Arabs, Middle Eastern subjects included Armenians, Jews, and Persians. A further description of subjects will be given in connection with the respective sections in which they appear.

Comparisons of Twelve-year-old School Children

This section will deal with results obtained from classroom groups of school children, each group being chosen so as to contain chiefly 12-year-olds. Twelve-year-olds were selected because in the Middle East a considerable degree of elimination from school occurs beyond age 12. Because of this elimination it is difficult to obtain representative population samples at higher age levels. Classes made up chiefly of 12-year-olds were tested in Bagdad, Iraq; Beirut, Lebanon; Cairo, Egypt; Damascus, Syria; and Tehran, Iran. The testing was done in the fall of 1958, and the spring of 1959.

As noted earlier, testing was done also in the American Community School of Beirut. Students in this school comprise the majority of American children in Beirut. They are children of United States government employees, of American businessmen, and of the faculty of the American University. Most of these children had been in Lebanon for 1 to 4 years.

In each group, aside from the Americans, at least one school from a relatively poor neighborhood and one from a well-to-do neighborhood was tested. In each socioeconomic group both boys and girls were included.

In this section of the report data will be used from Christians and Moslems in Beirut, and from Moslems only in the other cities.

In the results that follow the total number of children were as follows: Americans 41, Bagdad 108, Beirut 230, Cairo 98, Damascus 104, Tehran 120, a total of 701 in the 6 groups.

Since at this age level comparisons of the sexes and of the higher and lower socioeconomic groups yielded differences that were statisti-

cally insignificant or unimportant, the results from two sexes and the two socioeconomic groups will be pooled.

Benevolence Scores

TABLE 1 shows the distribution of benevolence scores in each city and among the American subjects. Note the wide dispersion of scores in each column. In each group the benevolence scores have a range of 20 or more points. Nevertheless there are significant differences be-

TABLE 1

BENEVOLENCE SCORES

Twelve-year-olds

	American	Bagdad	Beirut	Cairo	Damascus	Tehran
25					1	
24					0	1
23					1	2
22					1	4
21	1	1	1		3	3
20	1	0	0		7	6
19	2	3	6		4	7
18	4	0	4		10	5
17	2	4	7		8	**8**
16	6	6	10		**8**	10
15	3	11	**8**	2	6	**16**
14	1	12	19	9	**12**	9
13	**3**	12	25	7	13	17
12	3	**15**	24	**8**	7	10
11	3	12	**27**	**8**	7	9
10	5	13	19	**18**	4	**8**
9	2	6	21	18	5	3
8	3	4	22	13	3	1
7	1	6	19	6	3	1
6	0	1	11	4	0	
5	0	0	1	3	0	
4	1	2	2	0	1	
3			2	1		
2			1	1		
1			0			
0			1			
$\bar{X}$ (mean)	13.44	12.17	11.17	9.77	14.57	14.98
S. D. (standard derivation)	4.01	3.17	3.65	2.55	3.98	3.74

Figures in bold face type represent the median

tween groups. The median and the mean benevolence scores of Tehran are 50 per cent higher than the corresponding scores for Cairo. Only 4 per cent of the Tehran children score below the median of the Cairo subjects. None of the Cairo subjects score above the Tehran median. The differences between Cairo and Damascus are only slightly smaller. Only 2 per cent of the Cairo scores are above the Damascus median. The American mean and median are about halfway between the highest and lowest Middle Eastern scores.

Complete item analyses have not been made, but examination of many answers indicate that in the Arab answers nationalism and patriotism play a larger part than they do in American answers, probably because loyalty to one's country is taken for granted in America but is a recent emergent in the Middle East. According to informants in Iran, the Tehran schools particularly stress loyalty to country and altruism toward one's fellow countrymen, a factor that may account for the high Iranian scores. Whether these expressed attitudes have more than a verbal reality it is impossible to say at present.

Malevolence Scores

The group differences in malevolence are even greater than the group differences in benevolence (TABLE 2). The lowest means and medians are those of the American students in Beirut. The highest central tendencies are those of Cairo, which are more than double those of the American group. Indeed, none of the individual Egyptian scores is below the median American score and all of the American scores are below the Cairo median. The Bagdad distribution is very similar to that of Cairo.

Among the Middle Eastern groups, the Iranians have the lowest malevolence scores. The highest scores are made by Cairo, Damascus, and Bagdad, cities strongly concerned with militant Arab nationalism. Indeed, at the time the data were gathered, the mass media of each of these cities were very active in stirring up hostility against one or more foreign powers. It is difficult to know whether the high malevolence scores of Cairo, Damascus, and Bagdad are a cause or a result of the attitudes that are frequently expressed by Arab governments.

A considerable number of the Arab answers scored as malevolent are concerned with nationalism. Thus frequent answers are the following: a boy is to grow up and fight for his country, or a brave man is to defeat his country's enemies. However by no means all of the malevolent answers given by Arab students are patriotic in character. For example, a lion is often said by Arab students to be for killing people and a storm is to destroy, whereas among groups with lower malevolence scores the lion is for the zoo and a storm is to bring rain. It appears from an examination of the detailed responses that the test reflects general

TABLE 2

MALEVOLENCE SCORES

Twelve-year-olds

	American	Bagdad	Beirut	Cairo	Damascus	Tehran
23					1	
22					0	
21				1	0	
20				0	0	
19				0	1	
18		1		1	0	
17		0		1	0	
16		1		3	3	
15		0		1	1	
14		4		5	1	1
13		3	5	13	1	0
12		2	3	7	6	2
11		9	8	11	10	0
10		18	19	15	13	3
9		17	25	9	13	10
8	5	11	26	11	19	9
7	3	12	34	10	13	14
6	5	13	42	6	17	25
5	6	7	25	2	3	18
4	8	8	20	1	2	19
3	8	2	13			13
2	4		6			6
1	2		2			
0			2			
$\bar{X}$ =	4.50	8.41	6.78	10.37	8.93	5.79
S. D. =	1.97	2.84	2.56	3.23	3.39	2.28

Figures in bold face type represent the median.

differences between groups in the expression of fear, suspicion, unfriendliness, and hostility.

Hedonism

The American students are highest in the number of hedonistic responses (TABLE 3). The hedonistic median and mean of the Americans are approximately 50 per cent greater than those of the highest Middle Eastern group and are twice as great as the scores of the two lowest groups Cairo and Damascus. Statistically, these differences are highly significant. It will be noted that no student tested in Cairo or Damascus

TABLE 3

HEDONISTIC SCORES

Twelve-year-olds

	American	Bagdad	Beirut	Cairo	Damascus	Tehran
25	1					
24	0					
23	6					
22	2					
22	2					
21	1					
20	3	2			1	
19	4	0			0	4
18	6	0			0	1
17	3	2	5		0	3
16	4	2	3		1	4
15	2	7	9		2	2
14	2	9	9	2	3	11
13	1	11	16	3	13	12
12	2	12	18	7	2	14
11	2	16	25	6	11	9
10	1	15	28	10	14	15
9	1	12	26	16	12	16
8		10	26	17	18	15
7		9	18	13	10	7
6		3	21	12	8	3
5			18	4	7	4
4			6	6	1	
3			1	1	0	
2			1	0	0	
1				1	0	
0					1	
$\bar{X}$ =	17.63	11.08	9.46	8.25	9.35	10.98
S. D. =	4.01	3.10	3.22	2.62	3.02	3.23

Figures in bold face type represent the median.

had a score above the American median and no American had a score below the Cairo and Damascus medians.

Implied in many of the American answers is the assumption that the individual is free to do as he likes rather than to be controlled by obligations, duty, social pressure, or religion. American answers are based upon individual freedom of choice as well as upon the love of pleasure. The Middle Eastern child is much less free than is the American child to act upon the basis of his own preferences. He is controlled

by his family at all times. His schools are much more authoritarian than are most American schools. He is expected, for example, to study, to work, to be serious, and to assist his family. Duty rather than pleasure is the childhood motif. The hedonistic scores appear to be true reflections of this emphasis as it affects the child.

Religious Scores

This category is made up of answers that indicate the religious function of objects or the religious motivation of actions. TABLE 4 indicates that Damascus has the highest religious score. Its median score is 4. The lowest group, the Americans, has a median of one. Naturally, differences among the remaining groups are necessarily slight.

In the preliminary work the small number of religious responses in all groups was surprising. Because of this a special effort was made

TABLE 4

RELIGIOUS SCORES

Twelve-year-olds

	American	Bagdad	Beirut	Cairo	Damascus	Tehran
18			1			
17			0			
16			1			
15			0			
14			1			
13			0			
12			0			
11			1		1	
10			3		1	
9		1	0		3	
8		0	4		2	
7		4	14	2	**8**	
6		5	10	3	13	1
5	1	13	33	10	23	3
4	5	15	33	16	**22**	7
3	7	**29**	**43**	**29**	22	24
2	4	28	48	28	6	**36**
1	**12**	12	32	9	3	36
0	12	1	6	1		14
$\bar{X}$ =	1.86	3.19	3.63	2.98	4.63	1.90
S. D. =	2.16	1.65	2.52	1.35	1.89	1.23

Figures in bold face type represent the median.

later to develop additional questions that would raise the religious scores. Among the new items were: What is a candle for? What are beads for? What is a feast day for? What is silence for? Why does one go without food? Why does one do good deeds? Why does one not eat certain foods? However these questions too seldom elicited religious answers among children. The evidence therefore is strong that in explaining the functions of common objects and the motivation of common actions, religious thinking is not prominent among Middle Eastern children.

Beirut Religious Groups

It has been indicated that the Beirut 12-year-old subjects for which results have been presented were made up of Moslems and Christians. In the present section the scores of these religious groups will be compared. In addition, data from a Jewish school in Beirut will be presented. It should be born in mind that the Christians among these subjects represent Middle Eastern churches and Middle Eastern ancestry. The Jewish community in Beirut also consists primarily of persons of Middle Eastern ancestry, immigration of Jews from Europe to Beirut in recent times having been slight.

TABLE 5 reveals that the differences between religious groups are small. The medians for benevolence differ only by 2 points, for malevolence only by 1 point. In religion the medians are identical and are uniformly low. Only in respect to hedonism is there a notable difference. In this respect the Jewish scores are significantly higher than the Christian and Moslem scores. This difference may be accounted for by the fact that the Jewish school that was tested follows the French educational tradition and has many European teachers. Other evidence, not presented here, shows that there is no consistent tendency in the Middle East for Jews to make high hedonistic scores.

Older Beirut Groups and Bedouins

The two preceding sections have dealt exclusively with results obtained from children. In most countries data were obtained only in the elementary schools. However, in Lebanon, results were also obtained from secondary school students, college students, and noncollege adults. The secondary school students consisted of 73 Christians and and Moslems, both boys and girls. Since few of the poorer children attend secondary schools, the middle class is chiefly represented. The college students were 33 students at the American University of Beirut and the Beirut College for Women. The 48 noncollege adults consist of illiterate male laborers, female adult students in Y.M.C.A. classes, and male skilled technicians of an airline company. In addition, responses were obtained from 28 illiterate male Bedouins living in the Syrian desert. The illiterates were necessarily questioned orally. Other

TABLE 5

BEIRUT RELIGIOUS GROUPS (12-YEAR-OLDS)

	Benevolent			Malevolent			Religious			Hedonistic		
	C	M	J*	C	M	J	C	M	J	C	M	J
20												1
19												1
18								1				3
17	2	2	1					0		1	1	3
16	0	3	2					1		1	1	3
15	1	2	2					0		1	1	4
14	3	6	6				1	0		2	0	5
13	4	7	1	1			0	0		3	2	3
12	5	5	7	0	1		0	0		1	2	3
11	3	6	8	0	3		1	0		3	6	8
10	7	8	1	5	2		1	0		7	8	4
9	3	5	7	3	9	1	0	0		5	8	3
8	3	7	5	6	6	6	0	1		7	6	1
7	5	6	3	10	1	5	2	8		4	6	2
6	4	2	3	8	19	13	1	4	3	4	10	1
5	1	0	1	1	8	9	8	11	3	3	7	1
4	1	0	1	6	5	8	10	9	4	1	2	
3	3	0		3	3	5	11	13	12	0		
2		1			3		7	13	14	1		
1							6	9	7	0		
0							1	2		1		

Figures in bold face type represent the median.

* C=Christians, M=Moslems, and J=Jews.

subjects answered the questions in writing.

I turn now to a brief consideration of these results, which are presented in TABLES 6, 7, 8, and 9. For comparative purposes, the scores of Beirut 12-year-olds are reproduced in these tables.

The differences between groups in benevolence scores and also in malevolence scores are slight. In Beirut benevolence and malevolence differ little according to age, education, and social class. In these respects the Bedouins, the least westernized group, do not make scores different from the urban groups. Apparently in the Middle East, education and urban living do not reduce hostility or induce a more friendly world view.

On the other hand, hedonism is decidedly related to education, social class, or both. The secondary students make higher hedonistic scores than the primary students, and college students make the highest scores of all. This increase in hedonism from primary school to college appears to be a function of education rather than age since noncollege adults

TABLE 6

MISCELLANEOUS GROUPS BENEVOLENCE SCORES

	Beirut 12-yr.-olds	Beirut H.S.	Beirut colleges	Beirut adults	Bedouins
23	1				
22	0			1	2
21	1			0	1
20	0	2	2	1	0
19	6	2	2	2	0
18	4	2	4	2	1
17	7	9	3	3	2
16	10	2	0	1	1
15	8	3	2	4	0
14	19	7	1	6	6
13	25	9	3	6	2
12	24	7	6	4	3
11	27	6	5	3	1
10	19	7	3	4	3
9	21	4	2	3	2
8	22	8	1	3	3
7	19	0	0	2	0
6	11	2	0	0	0
5	1	2	1	1	0
4	2	0		1	1
3	2	1		0	
2	1			0	
1	0			1	
0	1				
$\bar{X}$ =	11.17	12.38	13.49	12.46	13.07
S. D. =	3.65	3.81	3.75	4.40	4.31

Figures in bold face type represent the median.

have relatively low hedonistic scores. Among the Bedouins hedonistic scores also are low. Apparently low hedonism represents a cultural tradition of long standing since the Bedouins are the oldest of the extant Middle East groups.

In regard to religious scores, the Bedouins exceed all other groups that were tested. They retain a strong religious tradition that presumably once existed in Arab cities, and probably still exists in Jedda and Mecca but has weakened in other urban centers.

Summary and Discussion

Let us now review the findings, and attempt to assess the potential-

TABLE 7

MISCELLANEOUS GROUPS MALEVOLENCE SCORES

	Beirut 12-yr.-olds	Beirut H.S.	Beirut colleges	Beirut adults	Bedouins
14			1		
13	1		0		
12	0	2	0		
11	0	1	1		1
10	5	2	1		0
9	3	2	1	3	0
8	6	1	2	3	3
7	**10**	9	5	5	3
6	8	15	3	6	3
5	1	**10**	**6**	**6**	**4**
4	6	11	5	7	1
3	3	8	9	8	9
2		11		6	3
1		1		3	1
0					
$\bar{X}$ =	6.78	5.14	5.59	4.66	4.71
S.D. =	2.56	2.43	2.59	1.57	2.36

Figures in bold face type represent the median.

ities of the technique used.

The most extensive data have to do with 12-year-old children in several Middle Eastern cities. In benevolence scores Tehran subjects are highest, Cairo subjects are lowest, and American subjects are intermediate. In malevolence scores Americans are low, and those of Cairo, Bagdad, and Damascus are high. These differences in benevolence and malevolence scores in part reflect nationalism and patriotism. Patriotism in Tehran is expressed largely in terms of wishing to help one's country whereas in Cairo it is more commonly expressed as a desire to defeat one's enemies. However a general dimension of friendly-unfriendly world view appears also to enter into the benevolence and malevolence scores. These scores do not appear to be direct opposites. The American subjects, for example, are low in malevolence but not particularly high in benevolence.

Americans score highest in hedonism. This finding is congruent with the widespread observation that Americans are pleasure-seeking and self-determining in their actions. Middle Eastern groups of 12-year-olds are much lower in hedonism than are the Americans. In religious scores all 12-year-old groups that were tested were found to be low.

In Beirut 12-year-old Christians, Moslems, and Jews, all of Middle

TABLE 8

MISCELLANEOUS GROUPS HEDONISTIC SCORES

	Beirut 12-yr.-olds	Beirut H.S.	Beirut colleges	Beirut adults	Bedouins
23			1	1	
22			0	0	
21			1	0	
20			1	2	
19			3	0	
18		1	5	1	
17	5	3	5	1	
16	3	6	3	3	1
15	9	1	1	2	0
14	9	5	3	4	0
13	16	11	0	3	2
12	18	11	1	2	2
11	25	5	3	4	2
10	28	9	5	6	4
9	26	5	0	6	8
8	26	2	0	4	2
7	18	8	0	3	1
6	21	6	0	3	2
5	18		0	1	4
4	6		1	2	
3	1				
2	1				
1	0				
0	1				
$\bar{X}$ =	9.46	11.27	15.15	11.19	9.11
S. D. =	3.22	3.19	4.08	4.26	2.66

Figures in bold face type represent the median.

Eastern ancestry, were compared on all four scales. No significant differences were found except that the Jewish children were high on hedonism. This is believed to be due to the Westernization of the particular school that was tested. Religion in the Middle East appears to denote political affiliation rather than cultural distinctions.

In addition to studies of 12-year-olds data were also obtained on older subjects in Beirut and on Syrian Bedouins. It was found that high school students, college students, noncollege adults, and Bedouins do not differ markedly from 12-year-old Beirut school children in benevolence or malevolence. However, the educated, westernized groups are much higher than the elementary students and than the uneducated groups in respect

TABLE 9

MISCELLANEOUS GROUPS RELIGIOUS SCORES

	Beirut 12-yr.-olds	Beirut H.S.	Beirut colleges	Beirut adults	Bedouins
21					1
20					1
19					2
18	1				3
17	0			1	2
16	1			0	3
15	0			0	1
14	1			1	0
13	0			0	3
12	0			1	4
11	1			1	1
10	3			1	1
9	0			2	1
8	4			2	2
7	14			1	0
6	10	5		4	1
5	32	5		7	1
4	32	9	2	7	1
3	43	11	4	7	
2	48	26	10	6	
1	31	11	9	5	
0	6	7	8	2	
$\bar{X}$ =	3.63	2.53	1.48	4.79	13.50
S. D. =	2.52	1.60	1.16	3.56	4.60

Figures in bold face type represent the median.

to hedonism. All groups except Bedouins are low in religious scores.

These findings appear to support the following conclusions. The pervasiveness of religious ideas in everyday thinking, which probably once existed among Jews, Christians, and Moslems has largely disappeared in the Middle East. Today it exists among Bedouins and probably among a few other ultraconservative groups, but it is not common among Middle Eastern urban populations. The decrease in religious preoccupation in the Middle East may not be due exclusively to Western influences.

Hedonism, on the other hand, is highest where westernization is highest. Benevolence and malevolence seem not to be fundamentally related to westernization. The most westernized Arab cities, Cairo and Beirut, and the most educated citizens, college students, are as high

in malevolence as are Bedouins. Education and westernization per se seem not to reduce hostility.

While no quantitative comparisons between the findings and related social, anthropological, and historical data can be presented here, the data form a coherent picture that is believed to be consonant with other information on the Middle East.

It is encouraging to think that the technique demonstrated here may prove useful in the future repertoire of the psychologist who wishes to make comparisons between groups differing greatly in language and culture.

THE PROBLEM OF AUTONOMY AND DIVERSITY IN ANTHROPOLOGY AS A SCIENCE*

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In the works of Diogenes Laertius – that Greek sage known chiefly for his search for truth with a lamp in daylight – we find one of the earliest and most amusing definitions of man. Diogenes reports that when Plato once was asked to define man, he designated him as a featherless biped. Whereupon Diogenes went away, and returned carrying a plucked fowl, crying "Here you have Plato's man!" This led Plato to revise his first definition and to designate man as "that being with broad nails." Had there been monkeys in Greece, Diogenes would have had to make a second exit and return with a chimpanzee's foot. It is hard to guess what the great sages of antiquity would have presented as their final specific definition of man.

This story is told because it is evidence of the fact that, from its earliest days the "science of man" has borne the stigma that it still bears today: an insecurity as to its scope and a lack of clarity as to its fundamentals.

Searching for the reason for these deficiencies of the science of man by tracing the concept of anthropology through the ages, it is discovered that the concept changes constantly according to the *Weltanschauung* characteristic of this or that period. Anthropology proves to have no conceptional history of its own. During the century of scientific awakening it was simply a general knowledge of "how man was and how he acted." In the following century, in accordance with the general trends, it became more encyclopedistic. It is characteristic that the first use of the word anthropology in a book title was made by Otto Casman[1] in his *Psychologia Anthropologica* (1594). In the speculative 17th century, anthropology became a speculative discussion of the nature of man; in the 19th century, the century of "man as machine," it became a materialistic-physiological science. With the dawn of the humanitarian cosmopolitanism of the so-called classical period of European civilization, it again changed to become the vehicle of all-encompassing concepts; nevertheless, it was during this period that the most definite concept of anthropology as a science came into being. It was this period that produced such amazing polyscientists as Wilhelm von Humboldt, who wanted to cover the entire field of human knowledge. Humboldt's great

*This paper was presented at a meeting of the Division on May 23, 1960.

The Division of Microbiology held a Special Lecture on May 17, 1960, at which Aldo Castellani of the Institute of Tropical Medicine, Lisbon, Portugal, presented a paper on "Miscellaneous Mycological Notes." This paper will not be published by the Academy.

The Division of Engineering held a meeting on May 20, 1960, at which David Kaess of the M. W. Kellogg Company, New York, N. Y., presented a paper on "Scale Models and Photographs in the Drafting Room." This paper will be published in a subsequent issue of the *Transactions*.

contemporary Christian August Heinroth,[2] who wrote a number of outstanding textbooks, among them the first major textbook of psychiatry and criminology, also wrote the first modern text on anthropology, a text so lucidly organized and covering so completely all that anthropology should be concerned with, that it might well be used to improve many of our most recent texts.

However, anthropology did not remain on this classical level. It became a part of the 19th century's great scientific development. Under this influence, anthropology, at the end of the 19th century, became separated into two branches: on the one hand a natural and, on the other, a cultural science. The trend toward such a specialization had actually started much earlier. In Penny's *Cyclopedia*[3] of 1833, for example, we read: "Anthropology considers man as a citizen of the world and has nothing to do with the varieties of the races." Latham,[4] on the other hand, defined anthropology as "the study of man as an animal, the science which investigates the position of man sociologically." Today we still find this differentiation between physical and cultural anthropology, which in most of the English-speaking world is falsely believed to have been the result of a battle between the two British scientific capitals of Cambridge and Oxford.

Specialization, the basic pattern of modern scientific effort has inflicted its influence upon anthropology by creating unending differentiations. In a recent survey, *Anthropology Today*,[5] I counted more than 50 different spheres of what is presently called anthropological effort. It is impossible not to feel that this differentiation is causing the scientific horizon to vanish. In the new edition of Katz's *Handbook of Psychology*,[6] the following definition occurs: "Psychology is that part of anthropology which occupies itself with human behavior." Such definitions create confusion and raise the question of whether anthropology still has a meaning of its own or whether it is only a frame-science for several dozen special sciences, from paleontology to ethnology and from linguistics to the scientific study of religion. Of course, a return to the simple separation into physical and cultural anthropology cannot be considered a solution.

Nevertheless, and despite this Tower of Babel condition, there seems to me to exist an aspect from which the autonomy of anthropology can be identified and substantialized. It was not until the second decade of this century that the category of totality or wholeness was theoretically formulated by Hoeffding,[7] but the concept of totality in relation to anthropology as a science is not new. Wherever, in earlier history, an attempt was made to develop a "science of man," some kind of application of a total view is observed. In addition, wherever, in recent developments, a special science has raised itself to the level of anthropological outlook, it has been coordinated with a totalistic point of view.

It is the totalistic point of view that accounts for the high quality of

Heinroth's early text.[2] In 1898 Babrock[8] defined anthropology as the study of the whole man. A quarter of a century later the ingenious von Eichstedt[9] insisted that a real anthropology must be a *Ganzheits* anthropology. Also, Sol Tex,[10] in the supplement to *Anthropology Today* entitled *Current Anthropology*, expresses the view that "the pieces of anthropology are now and have always been joined together in a unique and functioning whole. ..."

The purpose here is to establish that the autonomy of anthropology is founded on totality. Acceptance of this insight may require some speculation. Such speculation should be directed toward overcoming theoretical aspects of the pluralistic specializations and attempting to realize the need of a unifying base in anthropology. We believe today that any basic theoretical scientific point of view, to be objective and exact, must be a specialistic one, and that any search for generalization and any kind of anthropomorphism must be subjective and unreliable daydreaming. There is, however, also a strictly scientific and objective approach to raising such anthropomorphism to the level of concrete and realistic anthropology.

This approach is not new. It has been applied frequently, especially in the cultural sciences, and has resulted in giving specialistic work the quality of greatness. Let us view, in this respect, Burckhardt's *Civilization of the Renaissance in Italy*,[11] the incomparable quality of which is that it not only describes facts of the life of Italy of the *Quatrocento* but has the anthropological point of view as background and seeks to incorporate all that can be known about human existence and history. Alternatively, let us consider what is probably the greatest work in the field of linguistics, which in its very title conveys a wide anthropological view: Otto Jesperson's *Mankind, Nation and Individual in Language*.[12] To this may be added what is probably the greatest achievement applying this totalistic anthropological point of view, Spengler's *Decline of the West*.[13]

This basic concept of anthropology differentiates itself, of course, from much of what is applied in scientific activities today in the form of specialized anthropology. Analyzing the underlying concepts of this specialized anthropology, an abstract or nebulous image of man is obtained that is unable to break through to a concrete totalistic conception. Only such a totalistic conception can become a realistic denominator joining differential efforts into a natural whole, giving them their proper places, and providing corrective insight into false one-sidedness or completely neglected aspects of a total field. It is the purpose of the rest of this paper to show how such a totalistic conception works concretely.

If anthropology is the realistic science that embraces all of the problems of man's existence, what should it mean in the life of us "anthroposes" of the North American commonwealth? If we use as a yardstick what is presented in *Anthropology Today*,[5] we see that anthropology today has little to contribute to the concrete and practical problems of

our existence; it is very much a scientific *L'Art pour l'Art,* science for the sake of knowing only, and not for practical application to public affairs or for making our lives more meaningful. The practical use of anthropology today does not go beyond its service to the United States Office of Indian Affairs.

In Europe, where I was born, anthropology was a practically applied science, in the first place applied to what in German is called *Bevölkerungs Politik:* population politics. It should be recalled that Max Weber's fame grew out of his study of the class distribution of religion, which showed that the middle and upper classes adhered primarily to one, and the lower class to the other, of the two major religions of Middle Europe. The governments of the vast colonial empires made abundant use of anthropology, but even internally, in France and Britain, with their conservative population structures, anthropological aspects were kept real. The separation of church and state in France would not have lasted 150 years without anthropological rationalization.

This country has considerably more population problems than the Old World had. The white-colored problem has been and will for a long time remain the sorest of American problems of social unrest. Although there has been political pressure to keep the issue out of the public eye, the 1960 presidential campaign has evidenced the seriousness of religious problems in our collective mind.

Nowhere else have ideals of racial and religious equality been made a more intensive object of political verbalization than in America, but at the same time nowhere else have these ideals had such a phantom existence in unrealistic illusion. On deeper topical examination we find that we live with these ideals only sentimentally and abstractly; they have a fictional character, like fairy tales. They are not anthropologically-conceived and realistically-experienced concepts; they lack in all respects the scientific basis; and the scientific basis can be only an anthropological one.

I am not the first to point to the lack of the development of an anthropology of the national life in the United States. The problem was close to the heart of one of the greatest of American anthropologists, Franz Boas. When Boas was working on his book *Race, Language and Culture,*[14] I saw him frequently. Boas emphasized what a scientific challenge it had been for him to be called to this country, where racial, national, and other concepts that had had the closest collective ties in Europe were being almost experimentally put to the test of international adjustment and social amalgamation. It was at that time that Boas had tried to initiate his studies of American Jews and Italians. He explained to me his belief that the social and cultural problems faced by the North American mass of mankind could be solved only if there were clear insight into the special character of the major national groups as they living now in this country, that we must become familiar with the desir-

able and undesirable traits of their racial character if outlets for desirable traits were to be provided and racial peculiarities constructively assimilated into the population. Boas was critical of most of our official population policies, especially of those in regard to the Negro question. In his posthumously published *Race and Democratic Society,*[15] he said that a critical survey of the literature on the Negro question had led him to the conclusion that it should be scrapped and done over again.

The only aspects of the American Negro problem that are to the fore today are the wholesale efforts at integration along lines of almost militaristic equalization. Some believe that this is at least the beginning of anthropological adjustment. However, a wrong beginning may be worse than none. I am not against integration, but I believe that, to be successful, integration must be carried out on the basis of a totalistic and sound anthropology, and not from the point of view of making everyone a potential voting citizen.

Those in charge of executing the task of integration do not even want to know about the differential needs and habits of the large variety of the descendants of the various racial groups. There is even a tendency to suppress knowledge and study of these peculiarities, and this occurs even in the supposedly most advanced circles. I am an ardent supporter of the aims of the American Civil Liberties Union, but I was disappointed when, recently, that organization protested against the inclusion of questions on race and nationality in the 1960 census forms.

What the people living in this commonwealth are by flesh and blood and by cultural and religious background should not only be carefully registered, but even more carefully studied, in order to avoid suppression of peculiarities. One wonders whether population politicians ever heard of Sigmund Freud and his theories about the devastating power of suppressed factors in human life, which multiply in explosive strength when they become collective. Have the mass movements from the time of the Reformation and through the first half of this century been forgotten? Anyone looking with the eyes of a Franz Boas at what has occurred during the last decade in the sphere of collective contradictions in this country cannot but see in it the prelude to serious and possibly violent racial unrest.

Let us look from another point of view at our national problems with regard to physical anthropology. Has or has not a racial group, large or small, the right, according to our postulations of freedom, to determine its own status? We have strict regulations against the entry into this country of disease-carrying plants and animals, but our regulations governing human immigration appears, in my opinion, to have been written by a clergyman a hundred years ago, with a little old-fashioned medicine added. Of course, we should not abandon our humanitarian policy of admitting to this country politically displaced persons, but we seem to shut our eyes to the fact that certain groups, after they arrive here, be-

come moral and social burdens. Would it not be more anthropologically sound to plan toward improvement and against lowering the status of our population? We see tragic shifts of population in our cities when certain groups move out of neighborhoods because other groups are moving in. Nothing is done for those who, more or less justifiably, feel oppressed. How strange it appears, from an anthropological point of view, that almost anyone has the right to break into any association formed by a group who wish to be by themselves. This is paradoxical, unrealistic, and abstract democratization. We are giving way to an unjustified one-sidedness. Instead of screaming about discrimination, we should seek the means to enable the various groups to live side by side and yet have their major desires satisfied. Those who become the unruly and criminal elements would not become so if their real needs were understood and acknowledged and if they were provided with the means of adjustment of their demands. Only practical anthropology can teach us to look constructively on human group powers and to respond sensibly to their demands.

Turning to cultural anthropology, let us begin with a little speculation. Education for ethical living, in primitive as well as modern society, has in general been the function of religion and its clerical practitioners.

During the long period of my connection with a juvenile court in this country I observed the predominance among the juveniles who appeared in the court of children of a certain national group who were also almost all of the same religion. My scientific curiosity led me to want to ascertain this statistically. However, according to the court administration, it was not permitted to note nationality or religion in the records. This applied not only to the state in question but to all penal institutions throughout the country. The Federal Bureau of the Census informed me that it was against the antidiscrimination regulations to make such tabulations, and the Department of Justice stated that while statistics on religion and race of legal offenders might be desirable, existing federal statutes did not permit the gathering of such statistics.

My anthropological speculation, however, could not be stopped by this administrative restriction. If it is proved that a particular national group in our population produces a disproportionate number of criminals and delinquents, should this not be made an issue in our population politics? Moreover, if the majority of criminal and delinquent acts are proved to be committed by adherents of a particular religion, should this not justify the commity itself in taking steps to correct the condition?

The religioethical aspect has been selected for discussion because its treatment in this country lacks the anthropological soundness and realism that the conduct of our national affairs demands.

This situation of course has a history. The earliest American immigrants were refugees from religious oppression. Our ideal of religious freedom doubtless stems from this. The early Quaker persecution, how-

ever, should remind us that religious freedom in America has always been a two-faced matter. In colonial days it was at least treated openly. Although religion in America is still a serious matter, real communal religious problems are no longer discussed and dealt with openly; they have become subjects of undercover manipulations of pressure politics. The reason for this is that the religious group that I referred to above as producing the major portion of the criminal elements in our society is more interested in gaining over-all power in the country than in fulfilling the task that, from the proper anthropological view, it should be fulfilling. Its rigid activity, even in the scientific field, has produced the collective conviction that to discuss religious communal problems, whether scientifically or popularly, is bigotry.

As a student of Max Weber and C. G. Jung, the problems of religion and its relationship to society, in the social as well as the psychological aspect, have always been for me a matter of serious concern. I have written a book,[16] numerous papers,[17,18] and have a book in preparation on religious conversion. Only recently, a periodical published by a highly belligerent religious group stated that within the next 50 years all religions in the United States except theirs would be reduced to unimportance. I am myself impartial in the matter of religion. It may be true that Paul Blanchard[19] is, as he has been accused of being, too legalistic. However, the facts that he has uncovered concerning the political pressure politics of one of our religious groups would, if restated from a wider anthropological point of view, show the misdevelopment of ecclesiastical functioning in this country has been much more serious than we realize.

Only proper anthropological study and insight would make it possible to obtain the right view of how religions ought to function in a democratic commonwealth. Of course, the point of view of Max Weber[20] in general and of Ernest Troeltsch[21] in regard to the social concepts of the Christian churches should be studied carefully. The reasons why most progressive European countries maintain restrictions with regard to certain religious groups should also be studied. Sweden and Switzerland, for example, have for centuries forbidden representatives of a certain religious group to enter their countries, and Austria and Holland permit the same group to settle only in remote parts of these countries. In this country the same religious group enjoys unlimited influence; for example, it makes unchecked subversive advances in law schools to transform American common law into un-American foreign legal code patterns.

In my studies of religious conversion,[16,17,18] I have pointed out that the most serious aspects of such religious activity are not the pressure politics, coercion, and undermining of moral patterns, but the wilful destruction of the mechanics of personal judgment and will that are the basis of a considerable proportion of the mental illness of our days, especially schizophrenia. I have called for serious study of the matter[22] with the aim of developing a legal basis for the control of religious

traffic. Discussion of this kind is, of course, fanatically fought and branded as bigotry by certain religious groups that want religious freedom only in so far as it serves the purpose of expanding their power and helping their attempts at coercion. In our anthropological view, therefore, present religious freedom is pretty much an illusion. Real religious freedom is the kind of controlled (government-controlled) freedom that someone not long ago designated as "the freedom to be left alone." And "alone," in this sense, means protected against conversion and coercion as they are applied today, especially by religious pressure groups.

My purpose here has been to call attention to how realistic and concrete the facts of our very existence become when a totalistic anthropological point of view is applied to them. The totalistic view brings the various spheres into a single view, interconnects them, and gives each its proper place and sound extension. I selected two anthropological borderline fields – population politics and religious coercion. Thus far these two fields have been dealt with individually. However, it is also desirable to show how much meaning anthropological "seeing together" has in the sound application of a proper science of man. We see today attempts in many countries to develop sound patterns of birth control. The worst enemies of birth control come from the groups that engage in the most extreme religious pressure politics. I do not need to tell you which part of the population of this country is most susceptible to such religious power politics. It is the same group that is most vulnerable to legal wrong doing. Only if we look at these individual facts from a totalistic anthropological aspect can we get a correct realistic view of them.

In concluding, let me discuss one further aspect that is a most serious one. During the first quarter of this century I lived in Europe. To a cultural anthropologist and social psychologist, it was interesting to watch what was at that time called "the dawn of the Communist era." The opportunity existed to study not only the neurotic ideological flare-ups in the Western countries, but also what was going on in Russia and the rest of the Slavic and Asiatic world. At no time have I felt that Sovietism would ever be able to take root in the West, because I believe that Sovietism is a specifically Slavic kind of social-association pattern. I believe this even more strongly today, especially in regard to this country. The fear aroused about the subversive power of the microscopic group of so-called Communistic ideologists represents an attempt to divert the public view from the real attempt to overthrow the democratic pattern formulated by the colonial fathers, which embraces the creed of freedom of race, color, and religion. There is no doubt, however, of the serious subversiveness of the powers active today in the field of religious and racial oppression, which may achieve their goal before the prophesied 50 years have elapsed. To fight this subversiveness, the best, and probably the only, tool we have is the kind of totalistic anthropology that I have tried to present here.

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DIVISION OF OCEANOGRAPHY AND METEOROLOGY

SOME METEOROLOGICALLY IMPORTANT RELATIONSHIPS BETWEEN THE OCEAN AND ATMOSPHERE *

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Introduction

The mutual influence of atmosphere and hydrosphere manifests itself in climate and weather phenomena and in the stratification and circulation of the oceans. The relationships are close between the atmospheric circulation and the ocean currents and among the humidity of the air, the evaporation over the oceans, the precipitation, and the salinity and temperature distribution in the sea.

The difference between the temperature of the air and of the water is a factor of special importance not only because of its significance for the development of characteristic meteorological conditions but also for certain physical processes in the oceans, which in turn may affect the atmosphere.

The geographical and climatological consequence of some of these mutual effects between the atmosphere and the hydrosphere is well known in those regions where, by the action of the prevailing winds, especially near the coasts, an oceanic circulation system develops accompanied by upwelling water and relatively cool sea surface temperatures. Over those regions, special climatic conditions prevail: a climate called by Koeppen (1934) "humid desert climate." The coasts of southwest Africa, northwest Africa, Peru and north Chile, and part of California are the best known examples. However, there are other coastal areas of much smaller extent where similar meteorological conditions prevail as a result of the same physical reason. An interesting example is given by a relatively small region along the coast of Venezuela where a humid desert climate is embedded in a belt of tropical rain forest climate with a bordering tropical savanna climate. Another example is Cape Frio off the coast of Brazil.

From the biological point of view, these coastal regions offer a striking contrast. The coast of Peru is such a picture in contrasts and anomalies. The land is barren, eroded, and almost wholly infertile. The sea, however, teems with sea life of all kind. The anomalous fact is the low

* This paper, illustrated with slides, was presented at a meeting of the Division on May 24, 1960.

The Division of Biochemistry held a meeting on May 24, 1960, at which Maurice Rapport of the Department of Biochemistry, Albert Einstein College of Medicine, Yeshiva University, New York, N.Y., presented a paper on "Immunochemical Studies of the Mammalian Cell Lipid." This paper will be published in a subsequent issue of the *Transactions*.

sea surface temperature in a latitude just south of the equator, as a result of the oceanic circulation induced by the prevailing wind system. If by some reason this anomaly is disturbed, probably triggered by only minor meteorological changes, the reaction of the atmosphere to the underlying sea surface may be disastrous. How the atmosphere reacts on such changes is most spectacularly illustrated by catastrophic meteorological effects off the coast of Peru, when the cool Peru current disappears from the coast and the El Nino spreads its water masses southward causing a rapid rise in sea surface temperatures.

Besides these coastal regions of anomalous sea surface temperature there are others in the open sea. It is to be expected that their effect on climate and weather would be similar to that observed in the coastal regions of upwelling water. However, the consequences of anomalous sea surface temperatures in the open sea are not always as evident as they are over the large areas off the west coasts of the continents. One reason for this is probably the fact that the development of anomalous sea surface temperatures in offshore regions is a temporary feature, which may persist for a longer or shorter period of time, and then suddenly disappear or drift away, while gradually changing its characteristics.

The Origin of Sea Surface Temperature Anomalies as Related to the Atmospheric Circulation

The analysis of observations on periodic and nonperiodic fluctuations of the sea surface temperature in the open North Atlantic Ocean has shown that anomalistic temperature variations appear almost simultaneously over large regions of the ocean. In some cases they show a remarkable trend toward persistency. Even in the monthly mean for a given oceanic region the anomalous fluctuations of sea surface temperature appear large enough to be significant as a source of possible changes in large amounts of energy made available to the atmosphere. A study of the origin and the behavior of these temperature anomalies and their variations (Neumann, 1950) showed that horizontal advection of water masses was not the major cause for such sudden changes in sea surface temperature. These changes are rather the result of local mutual adjustments between the field of oceanic circulation and the field of mass, which is largely determined by the temperature distribution in the sea.

In a stratified ocean where both temperature and current velocity decrease with depth, isothermal surfaces cannot be horizontal. They must be so inclined that in a moving layer of water on the Northern Hemisphere the cooler water is found on the left-hand side and the warmer water on the right–hand side, when looking in the direction of the current. An example of this temperature distribution is shown in FIGURE 1 for a typical section through the Gulf Stream.

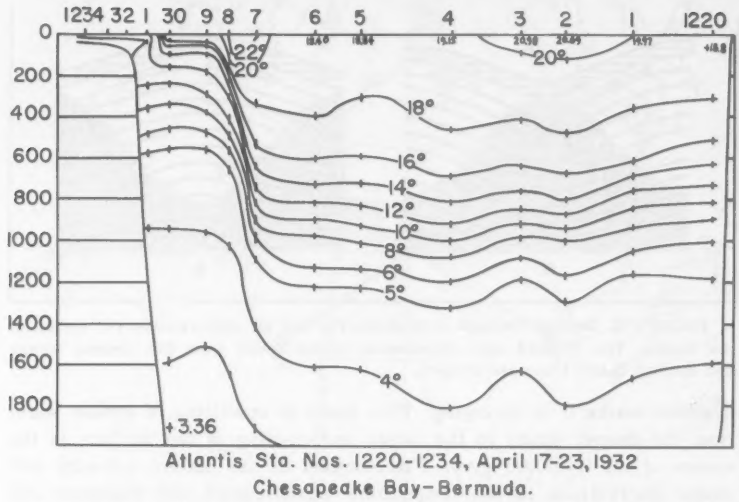

FIGURE 1. Vertical section through the Gulfstream showing the distribution of temperature (Iselin, 1936).

If the current increases in speed in the upper layers, which in most cases is the result of an increase in the wind field over the water, the dynamic consequence is that the slope of the isothermal surface increases. Hence at any level, and also at the sea surface, the temperature must drop in a region along the left-hand side of the current and rise along the right-hand side. In cases where the current slows down and the vertical velocity shear diminishes, the isothermal surfaces decrease their slope across the moving layer, and the result is that the temperature difference across the current weakens, that is, the temperature rises along the left hand-side of the current and drops at the right-hand side.

In addition to this effect there is the effect of upwelling and vertical mixing. Maximum upwelling occurs in the region of maximum surface divergence. The water supply in the region of divergence will be almost vertical in the nearly homogeneous wind-stirred surface layer, whereas in deeper layers it follows more or less isentropic surfaces.

In FIGURE 2, examples are shown for an anticyclonic and a cyclonic vortex in the oceans and how the temperature field adjusts to the current field if the current velocity decreases with depth. The anticyclonic vortex is characterized by a deep-reaching core of warm water accumulated around the center of the gyre. The cyclonic vortex is characterized by a cold water core bulging up from cooler, deeper layers. Moreover, in the center of the wind-driven anticyclonic vortex, the water is converging in the surface layers of the ocean, and in the center of the

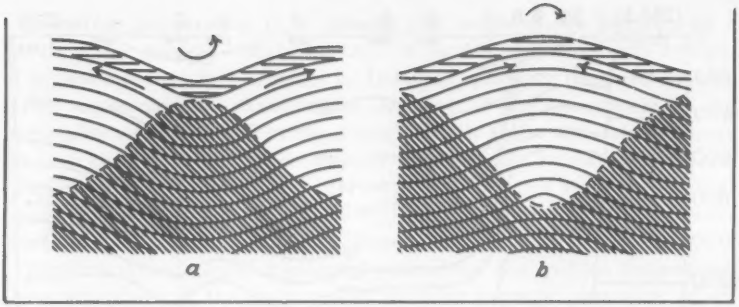

FIGURE 2. Section through a cyclonic *(a)* and an anticyclonic *(b)* vortex in the ocean. The shaded area represents cooler water from the deeper layers and the full drawn lines are isobars.

cyclonic vortex it is diverging. This leads to upwelling of cooler water from the deeper strata in the ocean and cooling of the surface in the center of the cyclonic gyre. Fluctuations of the current velocity will cause fluctuations in the temperature stratification and therefore will change the sea surface temperature locally over large surface regions almost simultaneously. It is possible that these locally generated anomalies propagate by horizontal advection.

Average Distribution and Seasonal Variations of Monthly Temperature Anomalies in the North Atlantic Ocean

A study of the fluctuations of average regional temperature anomalies from month to month in connection with the average monthly variations of the general atmospheric circulation has helped in understanding the mechanism that causes significant temperature variations at the sea surface (Neumann, 1950). For this purpose, eight regions have been selected for a first test. These regions are shown in FIGURE 3. They include: (1) two test fields in the Canary Current off the coast of northwest Africa; (2) one test field in the southern part of the North Equatorial Current at about 18° N. and 35° W.; (3) one test field at the left (northern) border of the Gulf Stream system at about 53° N; 38° W.; and (4) four two degree squares A, B, C, D in 55° N.; 47° W.; 41° N., 11° W.; 55° N., 15° W.; and 41° N., 45° W. for comparison.

For each test field, temperature anomalies $\Delta\overline{T}$ were computed by the difference between the long-term mean values and the corresponding zonal averages. They are correlated with mean air pressure gradients Δp over the region of the test fields. These pressure gradients are considered as a measure of the intensity of the wind field. For the test fields in the Canary Current and in the North Equatorial Current, the pressure gradients were taken between the end points of the dashed lines shown in FIGURE 3 from the charts by A. Defant (1916); for the

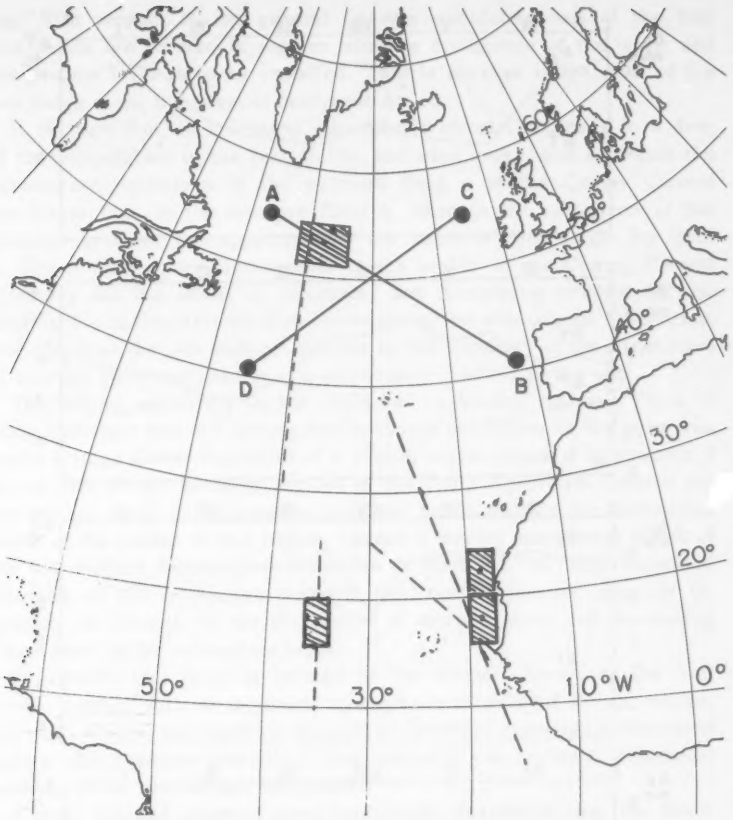

FIGURE 3. Locations of fields used in the first test.

test field at 53° N., 38° W. the mean monthly pressure gradients were taken between 30° N. and 55° N. along the meridian 40° W. from the United States Weather Bureau charts (1946). The reason that the latter were not used for the other three test fields is that it proved more accurate to use the original data published by A. Defant rather than to interpolate the air pressure from the isobars in the Normal Weather Maps.

The sample of curves presented in FIGURE 4 shows that the significant temperature anomaly variations during the year, which can be considered practically free from normal seasonal effects due to radiational heating and cooling, are correlated to the annual march of the air pressure gradient over the corresponding test field. This means that the temperature anomaly variations are rather the result of the intensity variations of the wind field than of anomalous seasonal heating or cool-

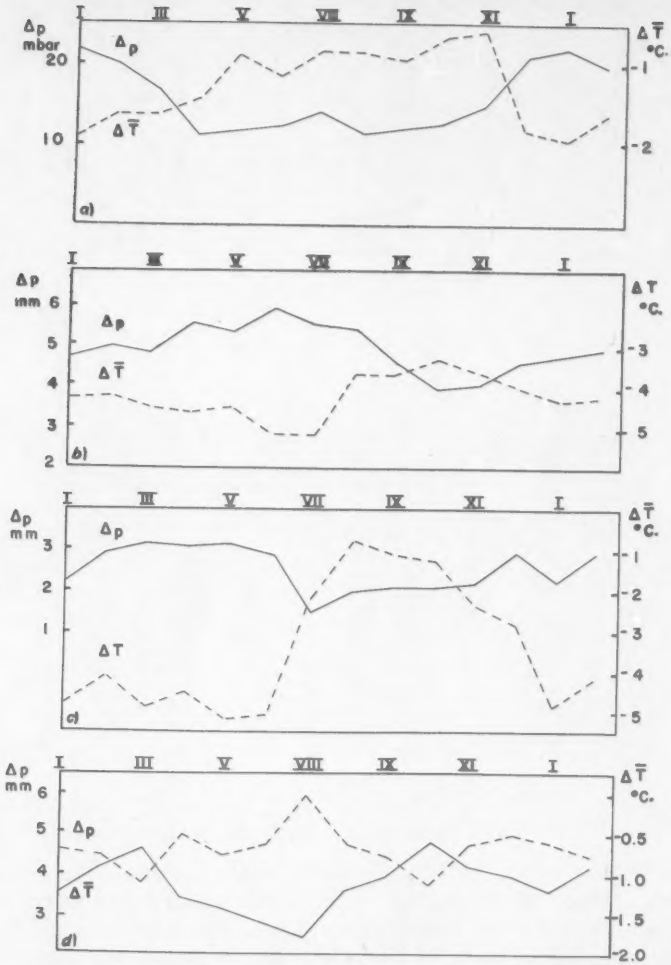

FIGURE 4. Air pressure gradient Δp and sea surface temperature anomaly $\Delta \bar{T}$ in selected regions of the North Atlantic Ocean. *(a)* $\Delta \bar{T}$ averaged for the region between 53° N. and 55° N., 37° W. and 39° W., Δp mean monthly pressure gradient between 30° N. and 55° N. along 40° W.; *(b)* $\Delta \bar{T}$ averaged for the region between 20° N. and 24° N., 18° W. and 20° W., Δp mean monthly pressure gradient between 25° N., 30° W. and Cape Verde.; *(c)* $\Delta \bar{T}$ averaged for the region between 16° N. and 20° N., 18° W. and 20° W., Δp mean monthly pressure gradient between the Azores (Pt. Delgada) and 50° N., 15° W.; *(d)* $\Delta \bar{T}$ averaged for the region between 16° N. and 20° N., 34° W. and 36° W., Δp mean monthly pressure gradient between 25° N. and 10° N. along 35° W.

ing. With respect to the general oceanic circulation, all of the four test fields are located in regions where a divergence of the water and the surface layer is to be expected. This is obvious in the case of the two fields along the coast of northwest Africa.

It is seen that an increased atmospheric circulation leads to a drop of the temperature in the test fields, and vice versa, and also that the temperature variations in the southern field c in the Canary Current are larger than in the northern field *b*, whereas the variations of the pressure gradient are approximately the same or even larger for field *b*. These temperature fluctuations in the region of the Canary Current evidently are the result of increasing and decreasing intensity of upwelling due to fluctuations of the intensity of the atmospheric circulation. The effect at the sea surface depends on the intensity of the divergence of surface water and the vertical temperature gradient in the sea.

This effect apparently is not restricted to coastal regions. There is much evidence that the temperature anomaly variations in the open sea are to a large extent the result of a similar cause. Graph *d* in FIGURE 4 shows that in the southern section of the North Equatorial Current the semiannual march of the pressure gradient, which reflects the semiannual march of the trades in this region, causes a similar semiannual march of the sea surface temperature anomalies at about 18° N. With increased intensity of the trades the normally negative temperature anomaly increases as a result of the divergence of surface water and decreasing temperature in the subsurface layers.

The fourth test field is located at the northern border of the Gulf Stream system. With an increased atmospheric circulation in fall, winter, and early spring, the negative temperature anomaly increases, whereas in summer with a weaker intensity of the westerlies the negative temperature anomaly of the sea surface decreases.

A more detailed study of many test fields distributed over the North Atlantic Ocean has shown that local changes of the atmospheric circulation are reflected in more or less intense variations of the sea surface temperature anomaly (Neumann and Pandolfo, 1958). This is most clearly pronounced in the region along the northern edge of the Gulf Stream system and the North Atlantic Current. All over the region between the Grand Banks and northwest Europe the sea surface temperature anomalies fluctuate in much the same way as the intensity of the westerlies, although the correlation becomes less distinct in the northeastern part of the Atlantic Ocean. However, between the northwestern and southeastern part of the North Atlantic there is a remarkable contrast. The boundary line between these contrasting regions coincides approximately with the axis of the North Atlantic Current. While northwest of this line the strongest negative temperature anomalies are found to occur in late fall, winter, and early spring, the reverse is the case in the southeastern region of the North Atlantic (FIGURE 5).

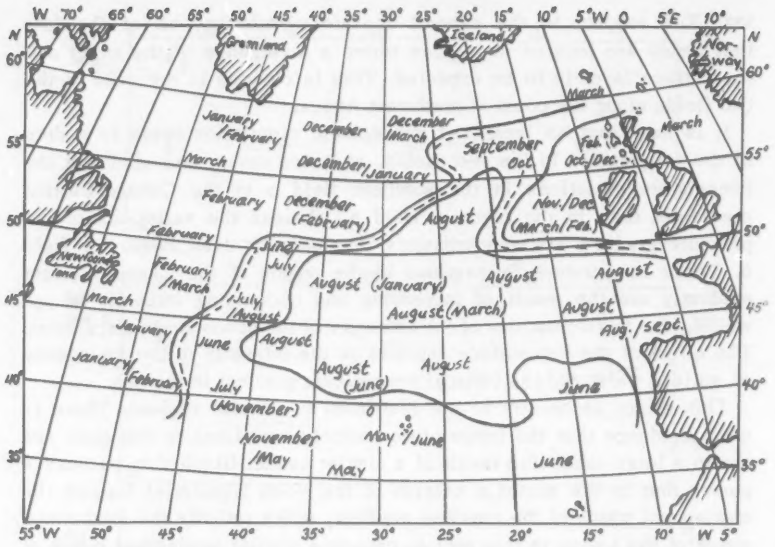

FIGURE 5. Map of the northern part of the North Atlantic Ocean showing the month of the occurrence of the "minimum" of the temperature anomaly (greatest negative anomaly) at the sea surface during the year.

The temperature anomaly fluctuations at the points A, B, C, and D in FIGURE 3 show roughly opposite variations. They are represented in FIGURE 6. With increasing west wind in fall and winter the anomaly at the northern test fields A and C drops, while it rises at the southern test fields B and D. In summer, with a decrease in the intensity of the wind, the opposite variations occur.

Nonperiodic Temperature Anomaly Variations in the North Atlantic Ocean

Nonperiodic sea surface temperature variations have been observed in the open sea where at certain locations the temperature changed by as much as 10° C. within a period of a few days. Even in the monthly mean, temperature anomalies of ±4 °C. may occur simultaneously over large areas of the sea surface that in some cases show a remarkable persistency. The question is whether the observed nonperiodic temperature anomaly variations from month to month or from year to year can be explained in a similar way as was shown for the average monthly anomalies in the preceding section.

For this study two sources of data were available, both of them based on temperature observations collected by merchant vessels for about the past 70 years. One set of data is given by the monthly means for individual months of the period 1878 to 1950 with some interruptions

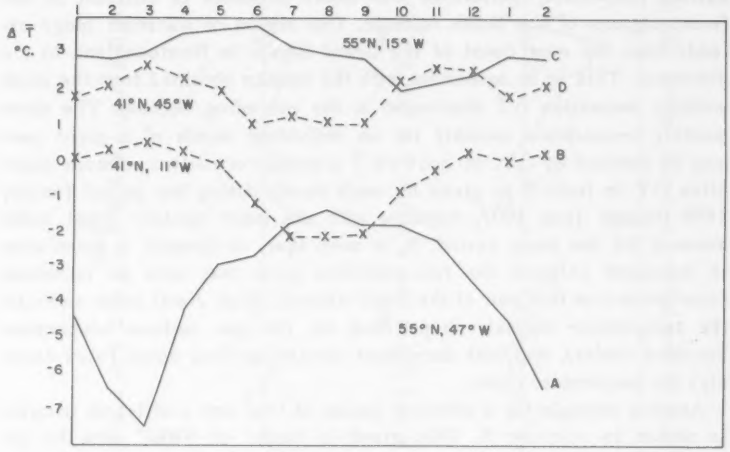

FIGURE 6. Annual march of the sea surface temperature anomaly in four selected 2° squares of the North Atlantic Ocean.

during the war. The data are published by Smed (1946 to 1950) as mean values for individual months in certain fields. The location of the fields is given in TABLE 1.

TABLE 1

Field	A	B	C	D	E
Boundaries	55°-70° N.	55°-63° N.	60°-66° N.	55°-60° N.	50°-55° N.
	60°-50° W.	50°-40° W.	40°-30° W.	40°-30° W.	50°-30° W.
Field	F	G	H	I	J
Boundaries	60°-63° N.	63°-67° N.	60°-63° N.	63°-67° N.	60°-64° N.
	30°-20° W.	30°-20° W.	20°-10° W.	20°-10° W.	10°- 0° W.
Field	K	L	M	N	
Boundaries	58°-60° N.	55°-60° N.	55°-60° N.	50°-55° N.	
	10°- 0° W.	20°-10° W.	30°-20° W.	30°-20° W.	

The second set of data are the temperature anomaly for 5° squares of the North Atlantic south of 55° N., obtained from the National Weather Records Center (NWRC) in Asheville, N. C. These data cover the period of record from 1880 through 1936. It is seen that the data by Smed and

the data from the NWRC supplement each other, and that both together cover almost the entire North Atlantic Ocean.

From an examination of the data it is observed that the range of sea surface temperature variations from month to month is different in different regions of the North Atlantic. One region of maximum range extends from the east coast of the Grand Banks in Newfoundland to the northeast. This is in agreement with the results obtained from the mean monthly anomalies $\Delta\overline{T}$ discussed in the preceding section. The mean monthly temperature anomaly for an individual month of a given year may be denoted by ΔT. In FIGURE 7 a sample of the temperature anomalies ΔT in field E is given for each month during the period January 1899 through June 1907, together with the mean monthly zonal index anomaly for the same period. It is seen that, in general, a correlation is indicated between the two variables such that with an increased circulation over this part of the North Atlantic (high zonal index anomaly) the temperature anomaly drops (that is, the sea surface temperature becomes cooler), and with decreased circulation (low zonal index anomaly) the temperature rises.

Another example for a different period of time and a different location is shown in FIGURE 8. This graph is based on NWRC data for the period January 1928 through December 1931. The sea surface temperature anomalies ΔT are given for the region at 40° N. and 35° W. and plotted against the anomaly of the air pressure gradient Δp taken between 30° N. along 35° W. The same inverse course of fluctuations in temperature and gradient is indicated in this sample of data.

The annual march of the correlation between pressure gradient anomalies Δp and sea surface temperature anomalies ΔT was computed for the fields E, N, F, K, and H (TABLE 1) using the data by Smed. In fields E and N, the correlation coefficients are negative and as high as –0.6 to –0.7 in February and March and approximately –0.5 in September, November, and December. In summer they may drop as low as –0.1 to –0.2 or even less. Although the annual march of the correlation between ΔT and Δp indicates strong fluctuations from month to month, it is clearly indicated that in the colder season the correlation between ΔT and Δp is much higher than in the warmer season.

The fact that in the colder season the correlation between ΔT and Δp (where Δp is taken at a right angle to the average wind vector) in field E, N, and K is higher than in the warmer season may be the result of the more intense fluctuations of wind speed during fall, winter, and spring. In summer the mean wind speed is much less; also, the range of the intensity fluctuations is much smaller than in the winter season. Hence the effect of fluctuations of the general atmospheric circulation on the general oceanic circulation and the resulting temperature variations is less pronounced in summer than it is in the colder season. Minor effects that may produce regional temperature anomaly variations

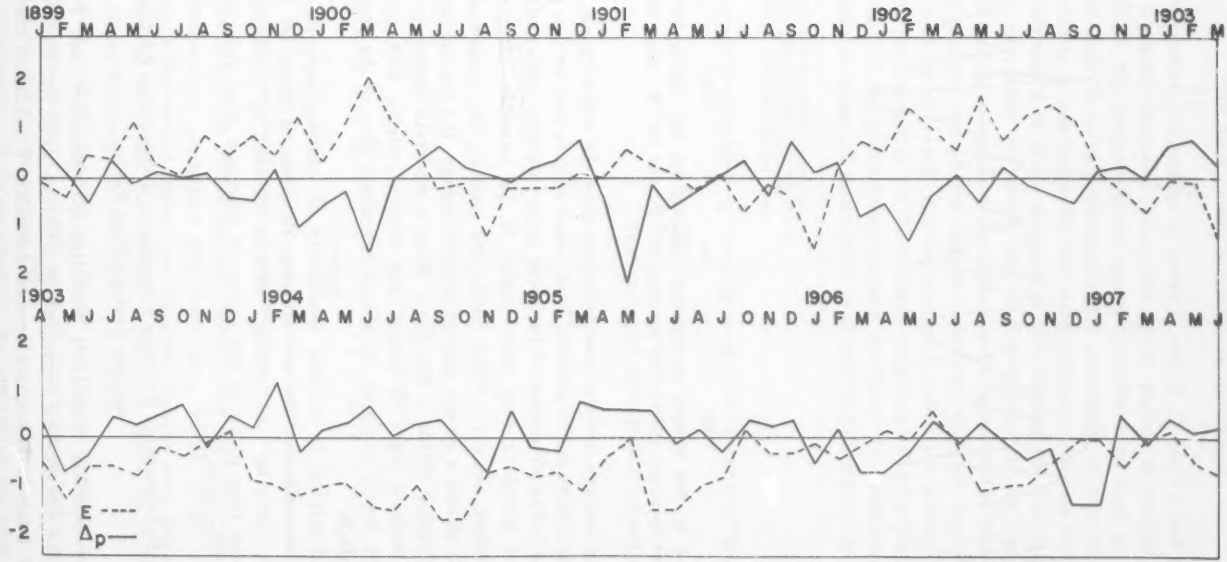

FIGURE 7. Mean monthly temperature anomaly and zonal index anomaly for each month of the period January 1899 through June 1907 for area E.

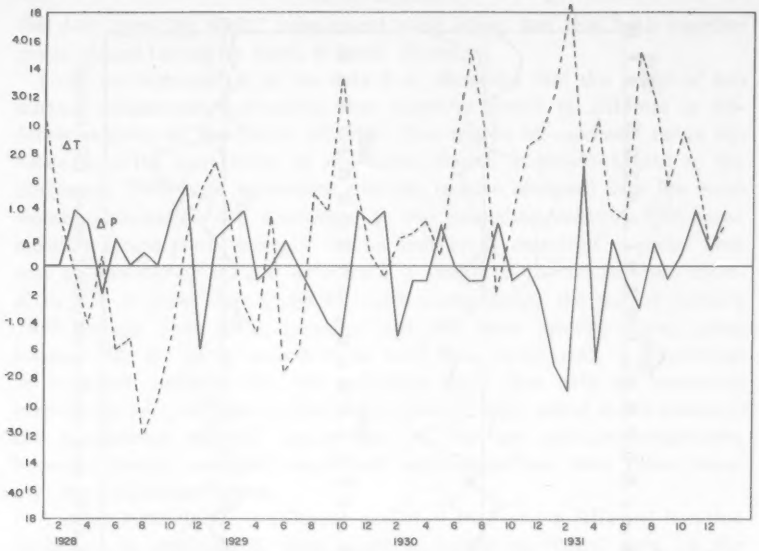

FIGURE 8. Sea surface temperature anomaly for the region 40° N. and 35° W. and pressure differences between 35° N. and 45° N. along 35° W. for the period January 1928 through December 1931.

at the sea surface become more effective than the major cause, and the correlation decreases in summer. Such minor effects may be due partly to anomalies in the absorption of incoming solar radiation, especially during periods of calms or very weak winds. If, for example, after a period of calm winds and clear skies during the summer, the uppermost layers of the sea absorb a greater amount of solar energy, the sea surface warms up considerably within a few days. When a moderate breeze comes up, the sea surface layer is stirred and vertical mixing with the colder subsurface layers produces an almost immediate drop of the temperature at the surface.

Vertical mixing is another possibility of causing nonperiodic temperature anomalies at the sea surface. However, it is to be expected that such "stirring" or "mixing" effects followed by a cooling of the sea surface take place in the region of maximum wind velocity where mixing is strongest.

Further Relationships Between Nonperiodic Temperature Fluctuations and the Average Wind Field

A more detailed statistical investigation (Neumann and Pandolfo, 1958) of the temperature anomalies in different areas and their relationship over large-scale regions seemed desirable. Correlation coefficients

for the temperature anomalies of areas E and N, N and C, and C and F (TABLE 1) were computed using the entire period of record, that is 1876 to 1950. By computing the correlations for time lags in 2-month increments from 0 months (simultaneous anomalies in the two areas) to ±24 months, it was expected that some estimate could be made of the relative importance of those changes in the temperature field due to the horizontal advection and those due to fluctuations in the large-scale divergence fields arising from the action of the wind on the sea surface.

For the regions considered, higher correlation for time lags of a few months would be expected, due to horizontal advection alone, with the sign of the lag dependent on the relative positions of the two areas and the direction of the predominant surface currents. To some extent this feature may be observed in FIGURE 9. However, this figure also shows

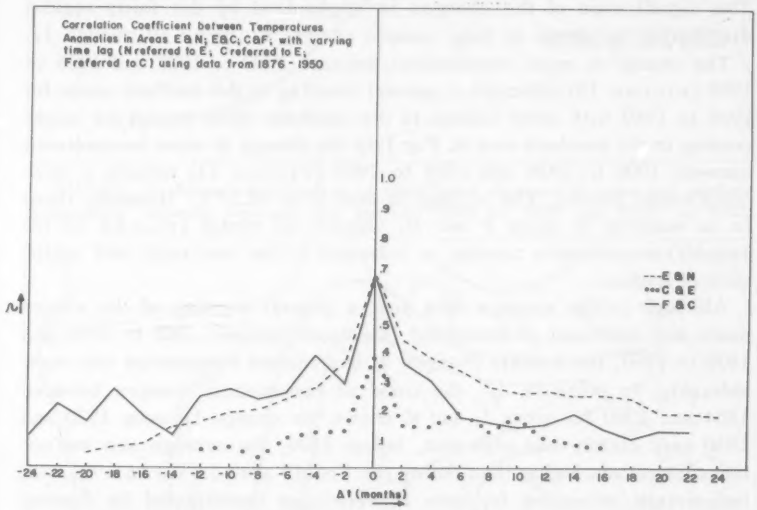
Correlation Coefficient between Temperatures Anomalies in Areas E&N; E&C; C&F; with varying time lag (N referred to E, C referred to E; F referred to C) using data from 1876 - 1950
1.0
.9
.8
.7
.6
.5
.4
.3
.2
.1
---E & N
•••C & E
—F & C
-24 -22 -20 -18 -16 -14 -12 -10 -8 -6 -4 -2 0 2 4 6 8 10 12 14 16 18 20 22 24
Δt (months)

FIGURE 9. Correlation coefficients between sea surface temperature anomalies of selected pairs of areas as a function of time lag.

that the coefficient is definitely and significantly highest when simultaneous temperature anomalies are correlated, which would indicate that a process that would cause simultaneous changes over large areas, for example one involving the surface divergence field, is at least as important as the horizontal advection in this regard.

During this statistical work a change in the computed correlation coefficients was observed, which occured in the three pairs of areas mentioned above some time around 1925.

In the investigation of these changes the anomalies for each of the areas A through N were averaged separately for each month of the year

and for the two periods 1886 to 1925 and 1926 to 1950. It was considered advisable to treat each month separately because the number of observations varied widely with season, with many fewer observations during the winter months in many areas, and also because the changes themselves might exhibit a seasonal variation as well as a geographical distribution. The averaged anomalies were then tested for statistically significant changes during the period of record (Neumann and Pandolfo, 1958).

The differences between the sample means were plotted on charts of the northern North Atlantic. The change for each area was indicated at the center of the area and lines of equal change were drawn. Changes not statistically significant were plotted as zero change, and no changes were plotted where insufficient data were available to carry out the tests. The significance of the changes is emphasized by the fairly regular distribution as shown in three sample charts, FIGURES 10 through 12.

The change in mean temperatures between 1900 to 1925 and 1926 to 1950 (FIGURE 10) indicates a general warming in the northern areas for 1926 to 1950 with little change in the southern areas except for slight cooling in the southern area N. For July the change in mean temperatures between 1900 to 1925 and 1926 to 1950 (FIGURE 11) reveals a more complicated pattern. The cooling in area N is -0.3° C. However, there is no warming in areas F and H, whereas in winter (FIGURE 12 for January) considerable warming is indicated in the area south and southwest of Iceland.

Although in the average of a year a general warming of the waters south and southeast of Greenland is noticed between 1900 to 1925 and 1926 to 1950, the monthly changes in sea surface temperature vary considerably. In FIGURE 13, the trend of temperature changes between 1884 and 1950 for areas L and M shows the change between 1920 and 1930 very clearly and also that, before 1900, the average sea surface temperature was higher than during the "cold" period 1900 to 1925. Air temperature anomalies for area N were also investigated by forming cumulative anomaly time series, which did not differ significantly from the sea surface temperature series with regard to the trends and transition years.

As was shown by Pandolfo (Neumann and Pandolfo, 1958), these surface temperature changes are closely related to changes in the general atmospheric circulation.

Remarks and Notes on Studies on Weather Trends and Sea Surface Temperatures

Investigations on mutual relationships between the atmosphere and the hydrosphere have been carried out for at least the past 60 years. Only a few of these from the more recent past may be mentioned, beginning with the works of V. J. Petterson, C. F. Brooks, C. E. P. Brooks,

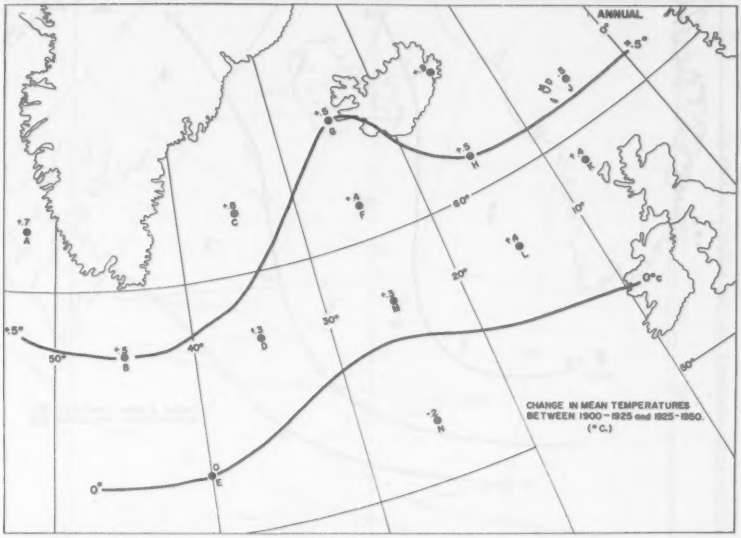

FIGURE 10. Annual distribution of significant changes in mean sea surface temperature anomaly between the periods 1900 to 1925 and 1926 to 1950.

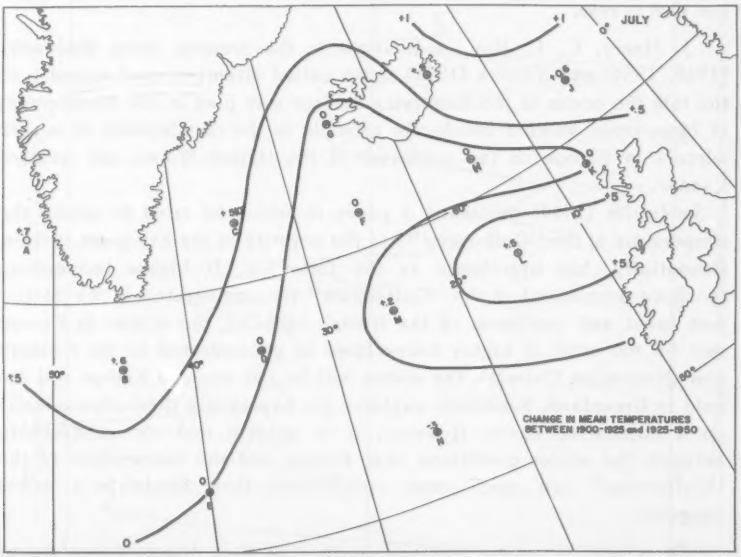

FIGURE 11. Distribution of significant changes in mean sea surface temperature anomaly for the month of July between the periods 1900 to 1925 and 1926 to 1950.

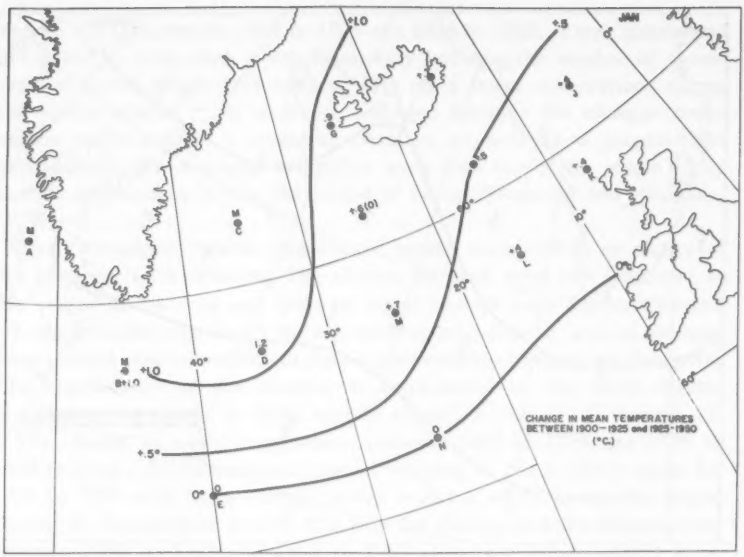

FIGURE 12. Distribution of significant changes in mean sea surface temperature anomaly for the month of January between the periods 1900 to 1925 and 1926 to 1950.

A. J. Henry, C. L. Ray, and others to the present, when Rodewald (1948, 1954) and Namias (1951) again called attention most urgently to the role the ocean or the underlying surface may play in the development of large-scale weather trends, for example in the development of severe winters in Europe or the northwest of the United States and western Canada.

Sandström (1944) published a paper in which he tried to relate the temperature of the "Gulfstream"* to the severity of the European winters. Essentially, his hypothesis is the following. If higher temperature (positive anomalies) of the "Gulfstream" is concentrated in its central part (west and southwest of the British Islands), the winter in Europe will be too cold; if higher temperature is concentrated in its northern part (Norwegian Current), the winter will be too warm in Europe and too cold in Greenland. Sandström explains his hypothesis thermodynamically on a qualitative basis. However, it is evident that the relationship between the winter conditions over Europe and the temperature of the "Gulfstream" are much more complicated than Sandström's model suggests.

*It is better to say that Sandström considers the North Atlantic Current and the Norwegian Current or the temperature conditions in the eastern North Atlantic or the eastern Norwegian Sea. The term Gulfstream is reserved for the flow along the east coast of the United States.

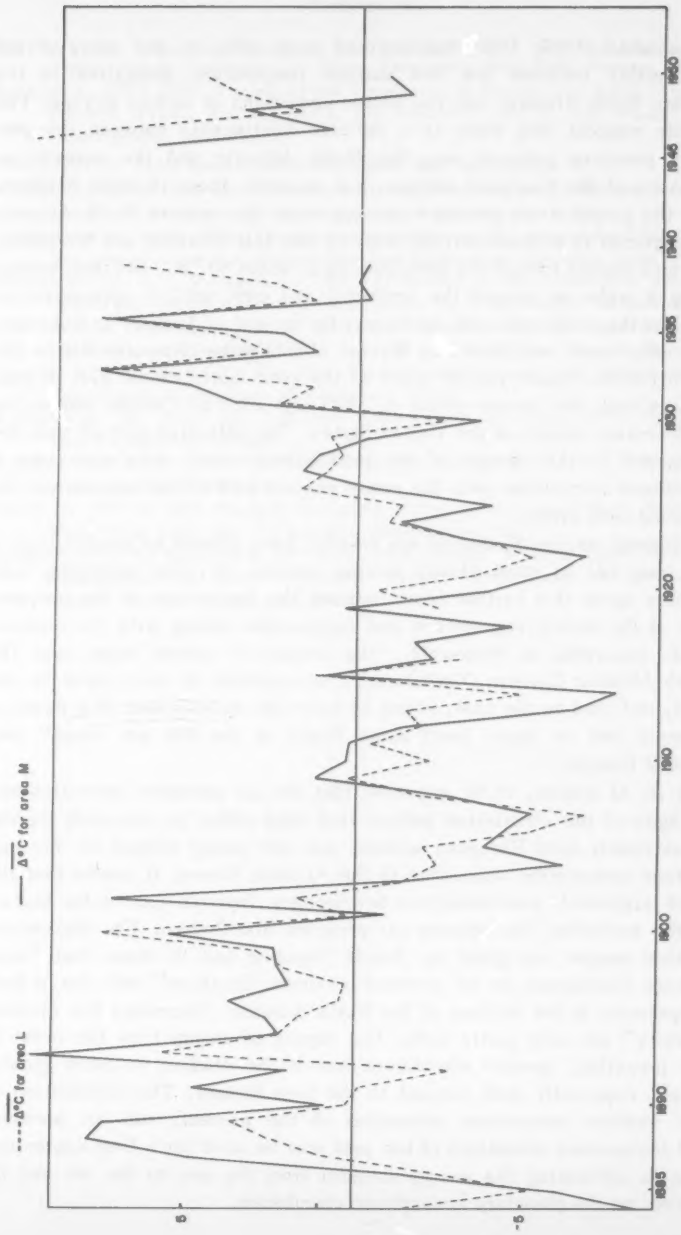

FIGURE 13. Annual variation of yearly mean sea surface temperature anomaly for the regions M and L.

Rodewald (1948, 1954) has devoted much effort to the study of the relationship between the sea surface temperature anomalies in the eastern North Atlantic and the winter conditions of middle Europe. The results suggest that there is a definite relationship between the previous pressure patterns over the North Atlantic and the severity or mildness of the European winters. For example, there is some evidence that the positive air pressure anomaly over the eastern North Atlantic is displaced in a characteristic way. In late fall (October and November) it starts moving toward the northwest up to about 50° N., and then swings along a wide arc toward the northeast and east until it approaches or reaches the continent north of Norway by the end of January or February. A similar trend was shown by Namias (1951) to be characteristic in the North Pacific Ocean for the track of the great anticyclonic cell in connection with the severe winter of 1949 and 1950 in Canada and in the northwestern states of the United States. The effective part of this development is the change of the predominant zonal circulation into a meridional circulation over the entire eastern part of the oceans and the adjacent land areas.

Although neither Rodewald nor Namias have offered an explanation of the long life of such slowly moving centers of rising pressure, both authors agree that certain facts indicate the importance of the temperature of the underlying surface and large-scale mixing with the environment. According to Rodewald, "the tongue of warmer water over the North Atlantic Current ('Gulfstream'), surrounded by cold water to the west, and land to the east, seems to favor the development of a positive anomaly and an upper level ridge (high) at the 500 mb. level" just west of Europe.

It is, of course, to be expected that the air pressure anomalies and changes of the circulation pattern that lead either to extremely severe or extremely mild European winters are only partly related to the sea-surface temperature anomalies in the Atlantic Ocean. It seems that the final large-scale meteorological development depends also on the history of the preceding and present air pressure distribution. The statements in this respect as given by Arnold Toynbee and V. Hann that "over a warm Gulfstream an air pressure minimum develops" and that a high temperature at the surface of the North Atlantic "increases the cyclone activity" are only partly right. The supply of energy from the water to the prevailing general circulation has to be studied in much greater detail, especially with respect to the past history. The distribution of sea surface temperature anomalies of the present, and air pressure and temperature anomalies of the past may be used for a first approximation in estimating the energy transfer from the sea to the air and its effects on the planetary atmospheric circulation.

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EFFECT OF ATTENUATED TUMOR TISSUE INJECTIONS ON THE SARCOMA 1A ASCITES TUMOR IN THE A/JAX MOUSE *

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Bronx High School of Science, Bronx, N.Y.

Introduction

This experiment was performed to see if a weakened form of tumor could produce some immunity in the host. Since 1902 a variety of experiments have been performed in which many forms of the patient's own tumor or a similar one were injected. The results, however, were inconclusive. In September 1959, an experiment was reported in which a patient's own tumor and an adjuvant (Freund's adjuvant) were made into a vacine that proved somewhat effective against human cancer. [1] In 1955 6-mercaptopurine was found to be a very effective antileukemic drug in mice. [2] This experiment made use of the combined effect of 6-mercaptopurine (6-MP) and injection of whole tumor tissue.

The sarcoma 1A ascites tumor was chosen because it forms a liquid tumor (ascites fluid) that can easily be mixed with a chemical and injected.

The experiment began with two pilot studies. The first, using 65 mice, established the fact that the sarcoma 1A ascites tumor was 100 per cent histocompatible in the A/Jax mouse. The second study made use of a Warburg constant volume respirator, which measures the oxygen consumption of tissues. It was found that after 15 mg. of 6-MP were added the oxygen uptake of the sarcoma 1A ascites tumor was reduced from 2.43 to 1.54 μl. of oxygen per mg. of tissue per hour.

For all experiments the stock mice containing the tumors were from four to seven weeks old. †

Techniques

The experimental animals were divided into four groups: (1) 13 mice receiving both tumor transplants and attenuated tumor injections, (2) 10 mice receiving only tumor transplants, (3) 9 mice receiving only attenuated tumor injections, and (4) 9 mice receiving no tumor or injections.

Tumors were allowed to develop for 7 days in 3 stock mice. After this time, the mice were sacrificed by means of separation of the cervical vertebrae. A mid-ventral incision was made in the skin and the ascites

* This paper was the first of five papers presented at a Special Meeting of the Section on May 26, 1960.

† All mice obtained from the Roscoe B. Jackson Memorial Laboratory, Bar Harbor, Me.

fluid was withdrawn from the abdominal cavity with a sterile syringe. The 23 mice in the first 2 groups were injected intraperitoneally with 0.2 cc. of ascites fluid.

The 6-MP was dissolved at a concentration of 10 mg. per cc. in a molar equivalent solution of sodium hydroxide.

Beginning one day after transplantation, 1 injection of 0.15 cc. (1.5 mg.) was given to the 22 mice in groups 1 and 3 for 2 days. On the third day, 2 stock mice were sacrificed, and 2.2 cc. of ascites fluid were transferred with a syringe to a sterile beaker containing 2.2 cc. of 6-MP. The liquids were mixed, and each of the 22 mice received an injection of 0.2 cc. of the solution. On the fourth day the mice received another 0.15 cc. injection of 6-MP.

A post-mortem was performed on every mouse with the results shown in TABLE 1.

TABLE 1

RESULTS OF POST-MORTEM

No. of mice	*Group*	*Days alive after transplantation*	*Cause of death*	*Post-mortem findings*
2	1	6	Wounds inflicted by other mice	
1	1	7	Unknown	No tumor noted
2	1	7	Tumor	
3	1	8	Unknown	No tumor noted
5	1	Alive after 3 months		
3	2	15	Tumor	
6	2	7	Tumor	
1	2	7	Unknown	No tumor noted
2	3	9	Tumor	
7	3	Alive after 3 months		
9	4	Alive after 3 months		

Discussion

Without sacrificing the mouse, it was extremely difficult to tell whether the sarcoma 1A ascites tumor had taken until it had reached

an advanced stage when swelling was apparent. Therefore, this experiment tried to compare only the death rates of the mice with cancer. Because of this difficulty, moreover, there was no way of knowing whether the attenuated tumor tissue was actually effective against the tumors or whether the tumors just were not able to remain alive after transplantation. Three possible reasons for this suggest themselves: (1) there was some chemical imbalance in the mouse, (2) the tumor became infected during transplantation, or (3) the tumor failed to secure an adequate blood supply.

To determine whether a mouse died from the tumor was easier. The dark red ascites fluid was visible through the peritoneum after skin flaps were laid back. When the peritoneum was incised, it was noted that the entire abdominal cavity was flooded with ascites fluid. In addition, the liver and kidneys were yellowish, a characteristic sign of advanced cancer. Solid tumors were found growing outside and throughout the abdominal cavity.

It was noted that 15.4 per cent of the mice receiving the injections of attenuated tumor tissue died from the tumor compared to 100 per cent of those that had received no injections of this suspension. The death of 5 mice from something that autopsy did not reveal could have been due to the toxicity of the 6-MP. Their death, however, makes any statistical analysis impossible.

Conclusions

Although it appears that the solution of 6-MP and ascites fluid retarded the growth of 5 of 8 of the sarcoma 1A ascites tumors in the A/Jax mice, no definite conclusion can be drawn for these results: (1) the number of experimental animals was far too small, (2) there was the possibility that the tumors could not remain alive after transplantation, and (3) two of nine of the mice developed a tumor from the solution itself.

Because there was no perceptible trend, no generalization can be made as to the time required for the different groups of mice to succumb to the tumor.

Summary

A suspension of 6-MP. and ascites fluid was tested on the sarcoma 1A ascites tumor in the A/Jax mouse in an experiment using 41 mice. Mice remained alive for three months with no visible sign of a developing cancer as shown in TABLE 2.

Acknowledgments

I am grateful to Samuel Bieber of the Burroughs Wellcome Research Laboratories, Tuckahoe, N.Y., and to Frederick R. Avis[3] of the Worcester Foundation for Experimental Biology, Shrewsbury, Mass., for their help in making this experiment possible.

TABLE 2

Group	*Surviving mice*	*Original No. in group*
1	5	13
2	0	10
3	7	9
4	9	9

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APICAL DOMINANCE*

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In 1881 Charles Darwin published his book, *The Power of Movement in Plants*. While not as famous as *On the Origin of Species by Means of Natural Selection*, this book did present a new concept in the study of plant growth. In it Darwin presented the results of a simple experiment that he had performed. Working with *Phalaris canariensis*, he removed the apical area from the coleoptiles of one set and allowed the other set to grow naturally. Lateral light was applied to both sets of plants, and he observed that the plants whose tips had been decapitated showed a markedly lesser degree of phototropism. This was the first experimental evidence of the control that the apical area has over the growth of the plant as a whole.

In testing for apical dominance, the first thing I wanted to determine was the extent of leaf inhibition in representative fast-growing and slow-growing plants.** The apical bud was removed in one set of plants, and the other set was allowed to grow normally in both natural and artificial light.† The growth periods for the fast-growing plant, *Phaseolus vulgaris*, were set at 8 hours and 24 hours. The slow-growing plant, *Philodendron*, had a growth period of 6 days. In each case, during the test period the leaves and petioles of the plants whose apical buds had been removed grew between 2 and 3 times as much as the controls,‡ and it was subsequently observed that the lateral buds of those plants started to grow until one bud assumed an apical role. It was assumed that the new apical bud carried on the same leaf inhibition as did the original one (TABLE 1).

Having demonstrated that there is an inhibition on the leaf growth caused by the apical bud, I attempted to determine the basic reason for this phenomenon. Two possibilities came to mind. First, that the apical bud itself uses so much of the autosynthesized nutrients of the plant that growth could not reach capacity. Second, that the apical bud produces some compound (or compounds) that diffuse or are transported through the phloem to the leaves and lateral buds.

To test which hypothesis was correct I experimented as follows. In one set of plants the apical bud was removed and placed on a small block

*This paper was the second of five papers presented at a Special Meeting of the Section on May 26, 1960.

**Apical dominance usually refers to the inhibition of the lateral buds caused by the apical bud, but I have extended the definition to include the inhibition of the apical bud over the lower leaves and their petioles.

†I used a combination of 100 w. tungsten and 40 w. cool white fluorescent to assure a complete spectrum, as suggested to me by L. H. Winchester of the Brooklyn Botanic Garden, Brooklyn, N. Y.

‡Leaf growth was measured in terms of the length of the median sagittal vein; the perpendicular to that vein at the widest point.

TABLE 1

Apical bud removed	*Leaf width*	*Petiole length*
Before growing period	4.55 cm.	4.55 cm.
After growing period	4.69 cm.	4.96 cm.
Change	+ 0.14 cm.	+ 0.41 cm.
Normal growth		
Before growing period	4.84 cm.	3.90 cm.
After growing period	4.91 cm.	4.14 cm.
Change	+ 0.07 cm.	+ 0.24 cm.

of agar (about 5 mm. × 5 mm. × 3 mm.) in the light, for 80 min. Then the agar block was placed on the redecapitated stem of the *P. vulgaris* plant. After a period of 8 hours I measured the amount of growth and found there was definite inhibition where the agar block had been substituted for the apical bud, but the degree of this inhibition was not as extensive as in those plants where the apical bud had been left intact. This difference could be accounted for because the apical bud would have been producing auxin for the full-growth period, whereas the agar block contained auxin produced for only 80 min., plus a possible increase due to differences in diffusion rate and concentration.

The results may be summarized as follows:

Apical bud removed	1.26 cm. average growth
Normal growth	0.66 cm. average growth
Agar block substitution	0.77 cm. average growth

Here I point out what was done with reference to auxin oxidation and destruction at the point of injury to the plant. According to Steeves (1953), inactivation at cut surfaces and injured tissue is common. Steeves feels that the inhibition can be eliminated or decreased by application of 0.01*M* KCN at the cut surface, or by applying polyphenol oxidase. However, despite these claims, R. M. Klein of the New York Botanical Gardens, Bronx, N. Y. (personal communication) feels that the KCN will injure the tissue of the plant even if used in low concentration, and that the yield of auxin is not greatly inhibited. On the basis of this opinion, I attempted to counteract auxin destruction by making clean cuts and trying to keep the surfaces moist. It is believed that this kept destruction at a minimum.

Having determined that apical dominance is an auxin phenomenon, an attempt was made to see if it could be produced artificially. The first auxin compound tested was indole acetic acid (IAA). This compound was chosen because of its dominant role in plant growth. As with most of the auxins, when it is in high concentration it will inhibit growth. Agar blocks were coated with IAA in a concentration of 0.25 gm./l. Then the apical buds were decapitated and the agar blocks placed on the stems.

After a growth period of 24 hours, the leaves were measured for increase in size as compared to a control. The growth appeared to be slightly greater than when the tip itself was removed. There was no inhibition. Because of the great concentration in which IAA was applied, I felt that it alone was not responsible for apical dominance. It is interesting to note that when IAA is applied to the leaves by swabbing with cotton, the amount of primary growth almost parallels the increase in growth when IAA is applied through the stem. Petiole growth was consistent with the leaf growth.

The next step was to apply the amino acid tryptophan. Tryptophan is the precursor of most of the natural auxins. There is an increased enzymatic auxin formation capacity in the plant, particularly after the apical bud has been removed. It was hoped that the tryptophan would be converted into a composite of auxins whose effect might be apical inhibition. Thus the test would be of many compounds, rather than of just one. The tryptophan was applied in the same way and in the same concentration as the IAA. However, the tryptophan, through the normal composite of auxins produced from it, caused a tremendous amount of primary growth. The results indicated that the normal constituent of auxins synthesized from tryptophan were not responsible for this inhibition.

Because the validity of the test was not certain, a chemical was applied that is known to afford a definite stimulation in growth over any reasonable test period. Using potassium gibberellate in the same way as the other compounds, there was the expected increase in growth, which paralleled that of the tryptophan.

When the plants were observed two weeks after the initial experiment, several quantitative observations could be noted. First, the average height of all the plants whose tips had been removed and where a chemical had been applied was less than that of the controls. Second, there was some lateral growth where the apical bud had been removed and where no stimulus had been applied. However, there was much more lateral growth in the plants where the tryptophan had been applied.* All the other plants had little or no such growth. With reference to flowering, there was some in the plants whose apical buds had been removed. However, the greatest by far was in the plants whose tips had been replaced by an agar block coated with tryptophan. Here the size of the apical buds were stunted. Except in the case of tryptophan and, to an extent, where IAA had been applied to the leaves, the apical buds were one dominant and one recessive. I do not know if any conclusions can be drawn from this, but it would appear that the tryptophan caused a change to reproductive tissue and also seemed to have had an effect on the lateral buds – but it was not apical dominance. All the buds were small and grew in profusion with none taking the lead.

*In this case, I refer to lateral growth as the growth from the cotyledon scars.

In the plants where IAA had been applied to the leaves (and thus in greater quantity), the results were similar but not quite as extensive as with tryptophan. It must be remembered that IAA is a single compound, while tryptophan is reducible to a variety of growth-stimulating and inhibitory compounds.

It seemed that if hormones that were present in a sample at a given time could be identified and measured, it might be possible to determine which are responsible and, by applying them to the plant, try to produce "artificial" apical dominance. The standard test for identifying auxins, at least until recently, was the Avena test. Here the effect of an extract of the plant on oat coleoptiles is measured by the gross curvature that the hormones impart upon the seedling. Unfortunately, this test gives the total effect of all the compounds present and does not indicate which individual ones are present or in what concentrations.

The method of ascertaining this latter information that seemed most promising was paper chromotography. The techniques generally used were too elaborate for use at home, and I therefore adapted a technique to my facilities. The plant tissues in question are placed on dry ice and then ground up in a meat grinder. The powder that results is placed in methanol at 0° F. for 12 hours. Then the extract, which contains both bound and free auxin, is buffered to a *p*H of 4.5 with phosphoric acid. An ether-based extract is made of the green "slosh," which is filtered. The ether is evaporated with a tank vacuum cleaner to 2 to 3 cc. from an original 500 cc. or more of extract. The remaining green "mush" is chromatographed using a solvent of isopropyl alcohol: amonia: water in an 80:5:15 ratio by volume. The indicator used is *p*-dimethylaminobenxaldehyde in 0.1 *N* HCl. This method gives a quantitative result that should, when refined, yield fair qualitative results. When I first worked it out, I felt it would not be wise to apply it to this problem because I could not be certain whether the results were correct. I had found no reference in previous work with which to compare my results. Therefore, I decided to work with photoperiodic plants that would afford a basis for comparison.

Xanthium spinosum and *Glycine max*, both short day plants, were exposed to both short day and long day photoperiods. Then the technique was applied. In those that had been in the light for a long period, no positive auxin identification could be made. However, in those cases where the light period had been short, a positive identification of IAA and other (not positively identified) hormones was made. This checked with the results of Vlitos and Meudt (1953).

Acknowledgments

I am grateful to Herman Gillary of the Biology Department, Jamaica High School, Jamaica, N. Y., for his encouragement.

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DIURNAL RHYTHMS IN *ORCONECTES VIRILIS* *

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It has long been known that many animals show increased rates of activity, color changes, or marked differences in structure at certain times of the day. Outstanding examples of this phenomenon are the cockroach,[1] whose increased activity becomes apparent at nightfall and the clam, *Mytilus*, whose valves open and close with the rhythm of of the tides.

To discover whether there is any type of environmental influence in *Mytilus* behavior, those animals that had shown this rhythm on the Atlantic seaboard were transferred in closed containers to the Pacific coast. While they were in the laboratory they continued to show their Atlantic valve-opening rhythm, but once introduced to the Pacific Ocean they adopted the Pacific tides schedule. We may conclude that the schedule of rhythmic activity is maintained by an internal biological "clock" but is influenced by environmental factors.[2]

To ascertain whether these rhythms are learned, the fruit fly *Drosophila* was used. It reproduces by the egg-larva-pupa-fly cycle. If the animal is raised in constant darkness, the time of emergence from the puparium is random. However, if the flies receive a single short dose of light during pupation, the number of flies emerging reaches a peak 24 hours later, and each 24 hours thereafter there is another peak. It is therefore concluded that the periodic mechanism is inherent and basic.[3]

C. S. Pittendrigh[4] postulated that there are subcellular "clocks" throughout the cytoplasm of protozoa that are duplicated and passed to the daughter cells. There is evidence, however, that in certain animals rhythms are controlled by a specific part of the body, as in the roach where the subesophageal ganglion seems to control rhythmic activity.[1]

If there is a biochemical factor that controls these rhythms, temperature changes should be reflected in the period of the rhythm; that is, biochemical reactions normally have a Q_{10} between two and three. However, the emergence rhythm in *Drosophila* does not change in period from 16° to 36° F., and the *Gonyaulax* interval varies from 22.8 hours at 16° F. to 26.5 hours at 26.7° F., a Q_{10} below one.[5]

The mechanism of biological "time-keeping" is yet to be fully understood and explained, but from experimental data we can say that diurnal rhythms are basic life phenomena present in most groups of animals.

* This paper was the third of five papers presented at a Special Meeting of the Section on May 26, 1960. The work described was done while the author was a member of the National Science Foundation Program at Yeshiva University, New York, N.Y., during the summer of 1959, at the laboratories of and with the advice of Roger Eckert of the Zoology Department of Columbia University, New York, N.Y.

Experimental Method

My work involved the observation of the diurnal heartbeat and locomotor (activity and walking) rhythms in the fresh water crayfish *Orconectes virilis*, the correlation of these rhythms, and the effects of certain variables upon them.

In order to facilitate the completion of these experiments, I established the following control conditions. The animals were kept in an incubator at 10° C., ±1°, a temperature low enough to allow the animals to survive for long periods of time with a minimum of food while permitting normal activity. The animals were kept in small plexiglass containers that contained sufficient water to allow the animal to live. For general experimentation, the animals were kept on a light-dark schedule similar to that of the outdoor environment.

A timing clock was placed in parallel with the lighting system within the incubator to provide automatic scheduling of the daily light-dark regime under which the animals were kept.

Locomotor activity (FIGURE 1). The locomotor activity of crayfish specimens is recorded quite accurately by employing a smoked-drum kymograph in conjunction with specially constructed lucite containers, each containing one crayfish. Each animal container is placed on a small pivot on the aluminum shelf of the constant temperature chamber so that, when a specimen moves in the container, its weight causes the lucite container to roll slightly, closing an electrical circuit by means of wire contacts on the periphery of the container. The momentary flow of current activates a signal marker that in turn makes a mark on the

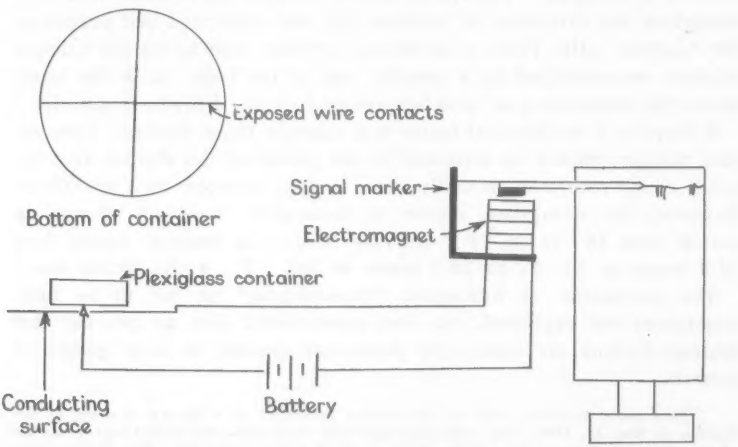

FIGURE 1.

kymograph drum. Each animal is represented by one such signal marker. While this is taking place, the kymograph drum totates once every 72 hours, recording, in the form of vertical marks, all activity that takes place during that time.

The kymograph record is interpreted by means of a special ruler marked off in hours corresponding to the rate of kymograph rotation. The amount of activity per one half hour is graphed: time as abscissa, activity as ordinate.

Sources of error in this recording method stem principally from the sensitivity limitations of the circuit closing apparatus and occasional inaccuracies in quantitative interpretation of results. Such errors, however, are of an apparently small percentage.

Heartbeat. By means of electrocardiography a diurnal variation in the rate of heartbeat can be observed in the crayfish.

Bio-electric events accompanying the heartbeat are picked up by two electrodes attached to and penetrating the crayfish's dorsal exoskeleton. Two small holes are drilled in the specimen's carapace, one directly over the posterior end of the heart and the other 1 to 2 cm. anterior to the first. Electrodes inserted into these openings and strapped into position do not significantly hinder the walking activity of the animal. Wires attached to the electrodes lead out of the constant temperature chamber in which the animals are maintained, leading the impulses to a Grass Model 5 Polygraph, which records the ECG on moving paper with an ink pen.

By means of a timing device, the Polygraph was activated for periods of 50 sec. at regular 20-min. intervals. The heartbeats recorded on the ECG paper were then counted and graphed to the same scale with respect to time as the locomotor activity. The ordinate of this graph represents the number of heartbeats during a 40-sec. sampling.

Similar light-schedule variations were applied to heartbeat cycle experiments as those applied to locomotor activity recordings. By using both the kymograph and polygraph recording methods, it was possible to record heartbeat and locomotor activity simultaneously in the same animal with no noticeable interference between the two instrument systems. In this way, activity and heartbeat cycle can be compared and correlated.

One problem encountered in crayfish electrocardiography involves the animal's physiological reactions to electrode insertion. About one half of all specimens die several days after their operation. This mortality may arise from damage to heart tissue inflicted during electrode insertion.

Results and Conclusions

I regret that, because of a lack of sufficient time, my data are not numerous enough to allow formulation of complete conclusions. However,

preliminary evidence has led me to believe that there is some relationship between an animal's heartbeat rate fluctuations, its locomotor rhythm as shown by the kymograph record, and its light-dark schedule, and furthermore, that the locomotor activity and heartbeat rates are greatest during periods of darkness.

At the present time the light-dark variable experiments on animals that have shown definite diurnal heartbeat rhythms have not been attempted, so it is not known whether the animal is really guided in its actions by some internal clock dependent upon the light-dark changes as its cue or whether the diurnal heartbeat rhythm is guided primarily by some other internal or external factor.

The heartbeat rate of crayfish varies greatly. It may range from 8 to 70 beats per minute in different animals. Incidental observation seems to show that there is an inverse relationship between the size of the crayfish and the number of heartbeats per minute; that is, the larger the animal, the slower the heartbeat.

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BEHAVIOR OF TRANSPLANTED HEARTS IN PLATYFISH*

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Introduction

Kallman and Gordon (1958) showed that fin tissue grafts in the platyfish, *Xiphophorus maculatus*, succeed when the donors and hosts belong to the same highly inbred strain. If host and donor belong to different strains, the host's cells react against the graft and destroy it.

When heart tissue is transplanted from a donor into a host of a different strain, it begins to beat by the third day. After a period of weeks or months, the host's immunological reaction sets in, the heart stops beating, and the transplanted tissue is completely destroyed.

The purpose of this experiment was to observe the nature of disintegration of grafted hearts and to see whether this disintegration destroyed enough of the heart to prevent its recovery when taken out of the incompatible host and retransplanted into a genetically compatible one. A study was also made to determine whether the rate of beat of transplanted hearts was affected by their disintegration in incompatible hosts.

Materials and Methods

The fish used in this experiment were two highly inbred strains of platyfish A and B and their hybrid offspring AB. In previous experiments, Kallman and Gordon showed that: (1) fin grafts from A donors into B hosts are rapidly rejected (1 to 2 weeks); (2) AB fin grafts into A or B hosts are also rejected, but more slowly (10 to 63 days); and (3) fin grafts from A donors into A hosts are permanently accepted.

The two types of heart transplants made were called primary and secondary. Primary grafts were those made from a donor into an incompatible host (such as from A into B). These were allowed to remain until they stopped beating. They were then removed from the incompatible hosts and retransplanted into compatible hosts (secondary grafts).

The donor was sacrificed and its heart dissected and placed in a dish of 0.6 per cent sea salt solution to prevent drying. The host fish was placed on a wet cotton pad. Another piece of wet cotton covered the front half of the fish to hold it still. With a fine glass needle, a slit was cut in the tail muscle into which the heart was pushed. The fish was put into an aquarium containing 0.6 per cent salt solution for 3 days to inhibit infection.

In the heart rate experiment, each host was kept in a separate aquarium and the rate of beat of its grafted heart was recorded every 3 days.

*This paper was the fourth of five papers presented at a Special Meeting of the Section on May 26, 1960.

Fish for histological study were fixed in Bouin's solution, decalcified with formic acid, embedded in paraffin, and sectioned at 10 μ. Staining of sections was done with Harris' hematoxylin and eosin.

Results

Retransplantation study. The first group in this study consisted of 8 primary transplants of hearts using A donors and B hosts. All grafts stopped beating between the 8th and 25th day after the operation. The remnants of these 8 grafts were retransplanted into AB fish. They disintegrated completely between 10 to 30 days.

The second group consisted of 24 primary grafts from AB donors into B hosts. Two of these disintegrated before they could be retransplanted, and three were fixed and sectioned for histological study. The other grafts all stopped beating between 26 and 110 days after the operations. Nineteen secondary grafts were made. Fifteen of them completely disintegrated. Two, showing signs of disintegration, were fixed and sectioned. Two secondary grafts began twitching in the secondary hosts, one of them 14 and the other 37 days after the operations. They both appeared as small bits of tissue with a reddish tinge embedded in the hosts' musculature. They were both fixed and sectioned 2 weeks after the twitching started (TABLE 1).

The third group was composed of 8 control fish of strain A. They received grafts from strain A donors. These grafts would have continued to beat for as long as the hosts survived. The retransplants into A hosts were arbitrarily made 2 weeks after the primary grafts began to beat. All 8 secondary transplants have been beating for 5 months and show no signs of disintegration.

Heart rate study. Two groups of transplants were made in this study. The first included 20 grafts from AB donors into A hosts. The rates of beat varied from 8 beats per minute (b.p.m.) to 180 b.p.m. Most rates, however, were between 35 and 55 b.p.m. The rates of beat also fluctuated between 2 and 20 b.p.m. from one 3-day period to the next. Temperature had a definite effect on these fluctuations. Thirty-two days after the grafts were made, the air temperature dropped from an average of 83° to 74° F. All the heart rates dropped an average of 40 b.p.m. In another test, rates of beat increased by 30 b.p.m. when the water temperature was artificially raised from 74° to 85° F. (FIGURE 1).

Although the heart beats fluctuated from day to day, the rates neither rose nor fell significantly while the hearts disintegrated. A total of 16 fish were observed until their grafts stopped beating. Four other fish died died before that happened but, while they lived, no changes in the rates of beat were observed during disintegration.

The second group of transplants consisted of 13 grafts from A donors into B hosts. As in the other group, the rates of beat varied among the

TABLE 1

SUMMARY OF GRAFTS IN RETRANSPLANTATION STUDY

	AB→A→AB																		A→B→AB							
FISH	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	1	2	3	4	5	6	7	8
NO. OF DAYS PRIMARY GRAFT BEAT	14	26	33	33	33	33	33	52	52	61	61	68	82	82	83	83	90	102	145	8	8	9	13	20	27	27	28
NO. OF DAYS SECONDARY GRAFT REMAINED	7	19	28	21	21	32	FIX. 35	FIX. 23	TW.	21	TW.	35	43	31	31	29	25	20	19	17	29	11	16	40	27	27	30

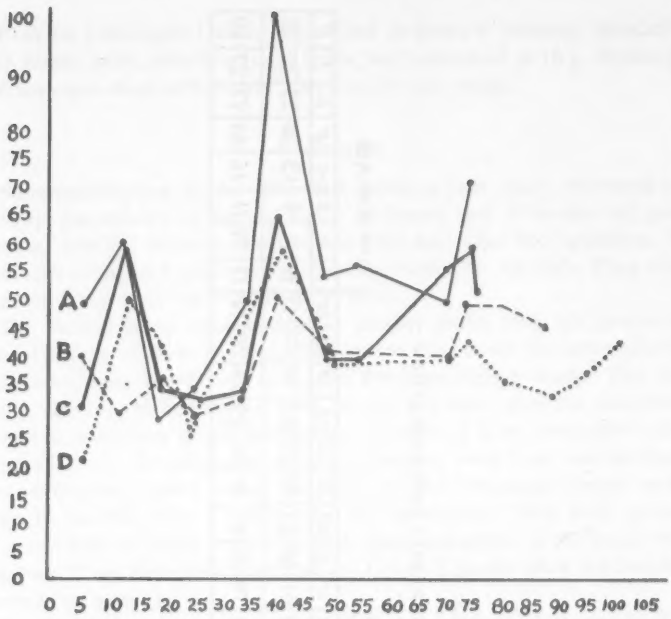

FIGURE 1. Comparison of four typical heart rates (AB into A grafts). Temperature of water rose 5° F. above normal on the 41st day. Note corresponding rise in rates. Graphs end where hearts ceased to beat.

grafts. No changes in the rates of beat were observed as the grafts disintegrated, aside from the usual minor fluctuations.

Disintegration of primary grafts. Disintegration of the hearts in all primary hosts apparently followed a similar pattern. The hearts first became filled with blood, which was pumped back and forth among the chambers of the heart as it beat. In some grafts, the entire heart beat in one convulsive movement; in others, the parts of the heart beat separately and at different rates.

As the immunological reaction proceeded, the hearts lost their blood and became pale. The rate of beat remained the same but was very weak (FIGURES 2 and 3).

The first of the 3 primary grafts that were prepared for histological study stopped beating and was a faint pink color when fixed. Observations of the sections showed that most of the heart had disintegrated. Around the remaining heart muscle fibers was a huge mass of lymphocytes. No erythrocytes were present.

Sections of the second fish showed a narrow space at the center of the graft containing some heart muscle and erythrocytes. The outer portion was surrounded and infiltrated with lymphocytes.

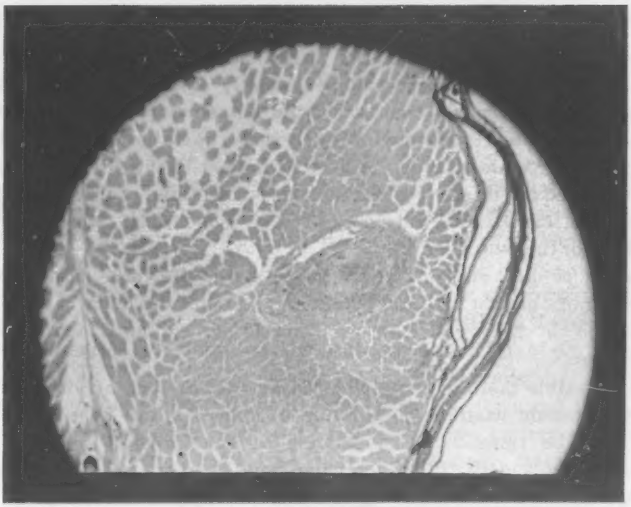

FIGURE 2. Section through heart transplant in incompatible host. Reproduced by permission of the *Annals of The New York Academy of Sciences.*

The third graft was red and healthy when fixed. It showed little disintegration of the muscle fibers and many erythrocytes in the heart cavity.

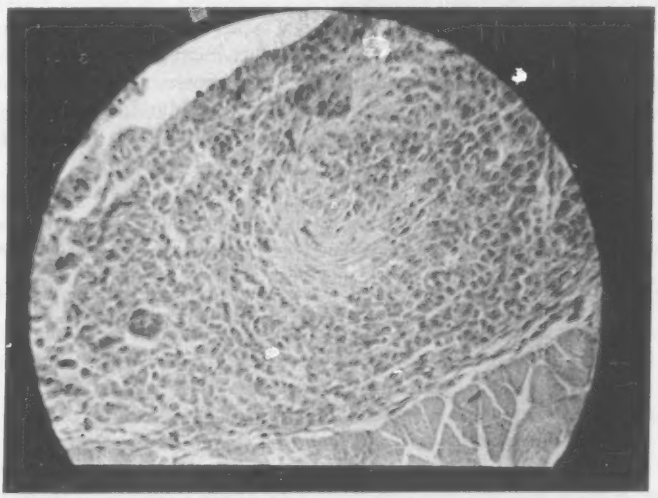

FIGURE 3. View of section in FIGURE 1 at higher magnification. Note light-colored core of heart muscle surrounded by darker lymphocytes. Reproduced by permission of the *Annals of The New York Academy of Sciences.*

Discussion

Results of the retransplantation study show that the reaction of the primary host to the primary graft permanently disables the heart, since nearly all the secondary transplants did not survive. The two that did survive never fully recovered. The primary hosts' reaction destroyed enough heart muscle to stop the beating but not enough to prevent some recovery when the tissue was retransplanted. Sections of these two grafts showed that there was a tiny core of heart muscle left, which probably accounts for the twitching.

Results of the heart rate study indicate that the rates of beat of the primary grafts are not affected by disintegration of the heart muscle. The fluctuation in the heart rate was due to an external factor, namely temperature.

It is possible that the beating continues only as long as vital parts of the heart remain unaffected. In future experiments, the chambers of the heart will be transplanted separately to see whether they can beat independently and to try to determine why heart transplants survive in incompatible hosts so much longer than fin transplants.

Summary

An experiment was carried out to determine whether transplanted hearts that had stopped beating in incompatible hosts could beat again when retransplanted into compatible hosts.

A total of 27 retransplants were made. Twenty-five disintegrated completely and 2 twitched slightly in the secondary hosts.

Observations of grafts in incompatible hosts showed that there was no significant increase or decrease in the rates of beat during disintegration.

Survival time of heart grafts is much greater than that of fin grafts.

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THE EFFECT OF HEREDITY ON EPIDERMAL CROSS GRAFTING IN CACTUS PLANTS *

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In recent years there has been great interest in the transplanting of living tissue for union with a new host. This interest is directed toward research that mankind hopes will revolutionize medicine: the eventual goal of successful transplantation of human organs including even eyes, hands, or kidneys.

Cornea transplants have been successful, and successful kidney transplants have been noted. However, intergrafting in human beings normally results in failure except when performed between identical twins. This is due to the hereditary factor. When grafts are attempted between genetically identical individuals, that is, identical twins, the grafts may be successful, but when transplants are performed between genetically different humans, the antigenic-antibody reaction of the host will destroy the foreign protein.

In plants that are less complex organisms there is less variation than in human beings. It follows that there is a greater genetic similarity between plants of one species than between two humans.

The question then entered my mind: What would be the effect of heredity on transplants between genetically identical and genetically different plants? By performing grafts between plants of different genetic constitution, I hoped to arrive at an answer to this question.

Information from texts revealed that grafting between different species and genera of plants is possible and has been performed. From Bernard W. Benson of the Boyce Thompson Southwestern Arboretum, Superior, Ariz., I learned that members of the Cactaceae are especially easy to graft.

I decided to utilize cactus plants in my experiment because of their outer rib or "epidermal tissue" that I was interested in transplanting. Most other plants have bark. All information about plant grafting dealt with the grafting of one cactus plant to another. I could not find any information on the grafting of the plant tissue in which I was interested.

The cactus plants that I employed in my experiment were *Aloe brevifolia* and *Opuntia elata*. These plants are characterized by comparitively large surface areas that permitted tissue grafting and few spines, which made their utilization desirable.

To clarify the role of heredity in epidermal skin grafting in cactus plants the following transplants (TABLE 1) were performed on April 16, 1960.

In Group I reciprocal grafts were performed from one part of an *A. brevifolia* plant to another section of the same plant. Since the epidermal

* This paper, illustrated with slides, was the fifth of five papers presented at a meeting of the Section on May 26, 1960.

TABLE 1

GRAFTS PERFORMED: WITH THEIR HUMAN ANALOGIES

Group I	Group II	Group III
A. brevifolia to same plant ▲ identical twins	*A. brevifolia* to *A. brevifolia* ▲ two humans not twins	*O. elata* to *A. brevifolia* ▲ Man to genera of ape

tissue came from the same plant, the grafts were genetically identical. Therefore this first group was analogous to grafting from a person's arm to the same person's leg, or to a graft between identical twins.

The second group of grafts was performed between two genetically unrelated *A. brevifolia* plants. Here an analogy may be made to two grafts performed between human beings who are not identical twins.

The last group of transplants occurred between two genera of cacti, an *A. brevifolia* plant and *O. elata* plant. This set of grafts provided different degrees of genetic variation, from none in the first group to relatively great variation in the third, in a similar manner to their analogous human grafts. Each group of grafts was performed twice (FIGURE 1).

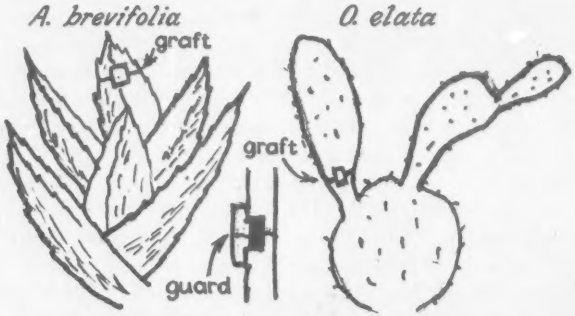

FIGURE 1. Transplantation between *A. brevifolia* and *O. elata*.

In performing the transplants, a razor was employed in cutting the epidermal patches whose surface areas were approximately one eighth of one square inch and whose estimated thicknesses were one sixteenth of one inch. The epidermal patches were then covered with flat rectangular guards made of toothpicks wrapped in wax paper. The guards were held over the grafts with string.

The guards' functions were to keep the epidermal grafts in contact with their new hosts and to prevent the plant and grafts from losing moisture. The guards were not very effective in keeping the grafts

against the plants, so the first guards were substituted for new ones that were T-shaped in horizontal position (FIGURE 1). These guards kept the grafts against the wall of the hosts.

On the *A. brevifolia* plants the transplants were performed towards the middle of the plant since the end sections die first and new ones develop in the middle. In the *O. elata* plants grafts were performed where a branch met the main body. This section was round and narrow, and all the nourishment for the upper sections of the plant passed the graft.

Some of the plants were damaged by the tightness in which the string was fastened in order to hold the guards stationary. The grafts and the host plants dehydrated slightly when the grafts were performed. The grafts that died turned tannish in color and were flat and completely dry. The successful grafts are green and fibers from the host would be seen connected to the grafts.

The results shown in TABLE 2 were achieved.

TABLE 2

RESULTS

Group I	Group II	Group III
A. brevifolia to same plant	*A. brevifolia* to *A. brevifolia*	*O. elata* to *A. brevifolia*
Successful		
1 of 4	1 of 4	none of 4

In group I one successful graft was achieved from four attempts. Some degree of success was anticipated because of its comparability to grafts between identical twins.

In group II one successful graft was achieved in four attempts. I did not expect a successful graft because this graft is analogous to grafts between humans who are not identical twins.

In group III there were no successful grafts in four attempts. According to reports, grafting one genus of cacti to another has been performed even though such grafts are analogous to grafts between man and genera of ape.

For grafts to be successful the plant must be vegetating. Growth in cacti is extremely slow and reaches its peak in spring. The possibility existed that, since there was little growth activity when these grafts were performed, the grafts would not have the opportunity to take even if genetically possible. Thus in order to stimulate the growth of the host plants, Gibberellic acid ($C_{19}H_{22}O_6$), a plant-growth stimulant, was utilized on April 26, 1960, on the five plants whose grafts were

then still alive. These plants were sprayed with a 10 ppm. solution of Gibberellic acid until the solution dripped off the plants. The Gibberellic acid appears to have had little effect on the plants, and the spraying may have damaged one graft.

My results seem to show that there is less genetic variation between two unrelated plants of one species than between humans who are not twins. This is supported by my successful graft in group II because grafts performed among its human analogy would normally result in failure. These results lead me to believe that certain grafts will be tolerated in cactus plants, while their analogous human transplants would not.

DIVISION OF MICROBIOLOGY

PRESENT STATUS OF ONCOLYTIC VIRUS STUDIES*

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The recognition that viruses may cause tumor destruction can probably be dated to 1912 when the Italian clinician N. DePace observed regression of cervix carcinoma in a patient undergoing Pasteur treatment because of a dogbite and postulated that the rabies virus may have caused oncolysis. The first laboratory demonstration of viral oncolysis was in 1922 when Levaditi, better known for his technique for staining spirochaetes, observed that vaccinia virus propagated in and sometimes inhibited various tumors of mice and rats. During the next 25 years at least 9 viruses were shown to be capable of causing tumor regression to some degree in a variety of tumors in mice, rats, rabbits, and guinea pigs. A detailed bibliography including these early studies will be found in Moore's review.[1] Further clinical observations also associated viral hepatitis,[2,3] measles,[4] rabies vaccination,[5] and varicella[6] with coincident tumor regression in rare instances and led to limited clinical experimentation with hepatitis,[2] rabies,[5] lymphopathia venereum,[6] feline agranulocytosis,[6] dengue viruses,[7] and Rickettsial pox[7] as experimental anticancer treatment. In these clinical trials there was at best suggestive regression of tumors in a few patients, and no virologic studies were attempted.

There was little general knowledge of or interest in this phenomenon, however, until the demonstration by Moore in 1950 that Russian spring-summer encephalitis virus infection in mice caused marked inhibition of five mouse tumors.[8] This led to intensive laboratory investigations and clinical trials that are the subject of this report. Moore's study demonstrated that a virus could cause rapid and complete tumor destruction, but it raised many basic questions. How common is the capacity for oncolysis among viruses? How commonly are tumors susceptible to destruction by viruses? By what mechanisms does a virus cause tumor destruction? Is virulence a necessary accompaniment to viral oncolysis? Can capacity for oncolysis be induced or enhanced by laboratory manipulation?

Since there has been no over-all plan in the choice of viruses or tumors for viral oncolysis studies, it is not possible to make more

*This paper, illustrated with slides, was presented at a meeting of the Division on May 27, 1960. New studies reported in this paper were supported in part by a grant from the National Cancer Institute, Public Health Service, Bethesda, Md.

than the general statement that many viruses and many tumors do demonstrate this phenomenon under suitable experimental conditions. A few viruses, however, have been studied against a variety of tumors with the finding of a characteristic and reproducible spectrum of susceptible tumors for each virus (TABLE 1). There is no tumor that is uniformly susceptible to oncolysis by all viruses. There is no virus that is uniformly capable of oncolysis against all tumors. It is not possible to predict on the basis of known characteristics of viruses or of tumors what combinations will result in oncolysis.

Only fragmentary knowledge is available concerning the mechanism of action of oncolytic viruses. It seems quite certain that for oncolysis a virus must enter into the metabolism of the affected cell. Viruses inactivated by antibody, formalin, or heat cause no oncolysis in otherwise suitable systems.[8,9] Adsorption of virus onto tumor cells with subsequent elution does not inhibit tumor growth.[10] In most studies there is growth of infective virus in tumors undergoing oncolysis, but in one system[9] virus propagation was incomplete, as indicated by an increase of complement-fixing antigen without increase in infective virus. Fluorescein-labeled antibody studies demonstrate that viruses are present within tumor cells rather than in stromal cells of the tumor tissue.

Although it appears that viral oncolysis is the direct result of cancer cell destruction by an invading virus, it does not follow that destruction of cancer cells is paralleled by pathogenicity for the host as a whole. Many examples are known in tissue cultures, laboratory animals, and clinical medicine where virus infection results in extensive virus propagation without any evidence of cellular destruction. Effective viral oncolysis with little virulence for the host has been reported in mice of the virus-resistant PRI line-bearing sarcoma 180 and treated with Russian spring-summer encephalitis virus, in rabbits bearing fibromatosis or myxomatosis and treated with Semliki forest virus, and in chickens bearing RPL 12 lymphosarcoma and treated with West Nile, louping ill, and other viruses.[1] It has also been possible in a fully susceptible host to prevent neuropathogenicity without inhibition of oncolysis by administration of an avirulent-interfering virus intracerebrally.[11]

Laboratory studies of viral oncolysis of human cancer are necessarily limited to tissue culture or heterologous transplant systems. Many different viruses can grow on and destroy tissue-cultured human cancer cells, but there is little correlation between the capacity of viruses to destroy cells in culture and their cytotropism and cytopathogenicity in the intact host. In studies of human cancer (HEp 3) transplants in conditioned rats and in fertile eggs, Bunyamwera, Bwamba, West Nile, Russian, and Semliki viruses showed the greatest tumor-destroying capacity among the viruses tested.[12] It is encouraging that the result in eggs, in rats, and in tissue culture showed a high degree of correlation, although cultured cells were generally more susceptible to cytolysis

than the same cells in *in vivo* systems. Suskind and his co-workers[13] showed that several adeno and Coxsackie viruses caused oncolysis of HeLa cells in conditioned rats. These heterologous transplant systems are technically cumbersome and the conditioning of the host by X ray or cortisone that is necessary to permit growth of the heterotransplanted tumor also decreases host resistance to the virus infection. In baby chicks bearing metastatic HEp 3 tumors, a system that does not require conditioning and in which viruses propagate with little virulence, no tumor inhibition was demonstrable using viruses that were oncolytic for HEp 3 in rats and eggs, although there was some evidence of oncolytic effect from a high-passage "adapted" line of West Nile virus.[14]

The production of viruses with clinically useful oncolytic effects might theoretically be accomplished by either reducing the pathogenicity of effectively oncolytic viruses or by increasing the oncolytic efficacy of viruses that are nonpathogenic for man. Moore[15] demonstrated that serial tumor to tumor passage of Russian spring-summer virus progressively increased its destructive capacity for that tumor. By this adaptation technique it was possible to produce an effectively oncolytic virus for a tumor (Wagner osteogenic sarcoma) that previously had been completely resistant to destruction by that virus.

Adaptation of viruses for greater destruction of human cancer cell lines was accomplished by Suskind and his co-workers[13] by passaging adeno viruses and Coxsackie viruses through HeLa cells in cortisone-treated rats, but passage in HeLa cell tissue cultures was unsuccessful. Suggestive evidence of oncolytic adaptation of Egypt 101 virus by tissue culture passage in HEp 3 cells has been published.[14] The above adaptation attempts did not diminish virus pathogenicity. However, Findlay and MacCullum[16] found that yellow fever virus passaged in mouse carcinoma 63 lost pathogenicity for monkeys.

In the experimental clinical studies of viral oncolysis at Memorial Cancer Center, selection of viruses has been limited to those that are oncolytic in some experimental tumor systems, that are of low virulence for man, and to which the local population is not generally immune. All patients had advanced cancer not responsive to any established method of treatment. Virus inocula were prepared from infected mouse brain, chick embryos, or human cancer cell tissue cultures. Administration was usually intramuscular, occasionally intravenous or intraperitoneal, and never directly into tumor. The viruses studied to date are four strains of West Nile virus (original isolate, Egypt 19, Egypt 21, and Egypt 101), Ilheus, RI-67 (a type 4 adenovirus), Semliki Forest, Mengo, Bwamba, Bunyamwera, Newcastle disease, Vaccinia, Rabies, Dengue and four recently isolated viruses: Rait, BrI, AMO-167, and Farouk. The last nine have been tried in only one to six patients. The most intensively studied has been the Egypt 101 isolate of West Nile virus because this infects approximately 90 per cent of patients treated,

TABLE 1

PARTIAL SUMMARY OF EFFECTS OF VIRUSES ON ANIMAL TUMORS*

Virus		Rabbit		Chicken	Mouse					
					Solid tumors					
		Brown-Pearce				Adenoca		MCI	Osteosa	
Category	Name	Ca	Fibroma	RPL 12 leukosis	Ca 63	E0771	Sa 180	Sa	Wagnar	Ridgeway
Psitt-LV	LGV	⊕		⊕	⊕					
Rabies	Rabies	⊕		⊕						
Pox-herpes	Vaccinia	⊕					⊕			
	Herpes sim.					*	⊕			
	Pseudorabies					⊕	⊕	⊕	⊕	⊕
	Virus III	⊕	●							
Poliolike	Polio II									
	GD VII			⊕						
	Passos I					⊕	⊕	⊕	⊕	⊕
	Mengo									
Myxo	Flu A					*	⊕			
	NDV						⊕			
	Avian pest	⊕			■		■			
Arbor A	EEE			⊕		⊕	*	⊕	⊕	⊕
	WEE			⊕		⊕	⊕	⊕	⊕	⊕
	VEE					●		●	●	●
	Semliki		□	⊕		⊕	⊕	⊕	⊕	⊕
Arbor B	SLE			□		●	■	■	■	●
	JBE			□		⊕	⊕	⊕	⊕	⊕
	WN			□			■	■	■	■
	Ilheus					■	■	■		
	Ntaya					⊕	⊕	⊕	⊕	⊕
	RSSE					■	□	■	●	■
	Louping ill			□		■	■	■	●	
	YF				■	⊕	⊕	⊕	⊕	⊕
Arbor (other)	Anopheles A									
	Anopheles B									
	Bynyam					●		⊕	■	■
	Bwamba					⊕	⊕	⊕	⊕	⊕

*Viruses and tumors studied only sporadically are not listed unless definite oncolysis occurred: □, oncolytic effect that was curative (host survived) under certain experimental conditions; ■, definite but nontherapeutic oncolysis; ●, slight or variable oncolysis; ⊕, no oncolysis; ♦, no oncolysis and no virus in tumor during lethal infection.[1,27]

EFFECTS OF VIRUSES ON TUMORS (Continued)

Mouse												
Leukemias (AK)			Ascites tumors									
									Lymphome			
4	9417	9421	Ehrlich	Sa 37	MCIM	Krek 2B	Induced	TA 3	No. 1	No. 2	DBA	6C3HED
			⊕	⊕	⊕	⊕	⊕	⊕	⊕	⊕	⊕	⊕
⊕	■		⊕	⊕	⊕	⊕	⊕	⊕	⊕	⊕	⊕	⊕
			⊕	⊕	⊕	⊕	⊕	⊕	⊕	⊕	⊕	⊕
●	⊕		⊕	⊕	⊕	⊕	⊕	⊕	⊕	⊕	⊕	⊕
⊕			□	■	■	■	●	■	■	■	⊕	●
⊕	⊕		●									
●			■									
			⊕	⊕	⊕	⊕	⊕	⊕	⊕	⊕	⊕	⊕
⊕			⊕	⊕	⊕	⊕	⊕	●	⊕	⊕	■	⊕
			●	■	■	⊕	■	⊕	⊕	⊕	⊕	⊕
⊕			●	◐	⊕	⊕	⊕	⊕	●	⊕	⊕	⊕
■		■	□	■	■	■	●	⊕	⊕	⊕	⊕	⊕
■		■	■	●	⊕	⊕	⊕	⊕	⊕	⊕	⊕	⊕
⊕			⊕	⊕	⊕	⊕	⊕	⊕	⊕	⊕	⊕	⊕
■			●	⊕	⊕	■	●	●	⊕	⊕	●	⊕
			⊕	⊕	⊕	⊕	⊕	⊕	⊕	⊕	⊕	⊕
			■	●	●	⊕	■	●	⊕	⊕	⊕	⊕
●			●	⊕	●	⊕	■	●	⊕	⊕	⊕	⊕
●			□	■	■	■	■	■	●	●	●	⊕

produces a minimum of morbidity, and has shown a fairly consistent capacity to propagate in the patients' cancer tissue. Data on clinical reaction, virus propagation and distribution, antibody formation, oncotropism, and oncolysis have been published for West Nile, Ilheus, and Bunyamwera viruses,[17] the Egypt 101 isolates of West Nile virus,[18,19,20,21] and the adenovirus RI-67.[22] Data on Semliki, Mengo, and Bwamba viruses are not yet published. Egypt 101 is the only virus that has produced any convincing evidence of oncolytic effect in clinical trials, so further discussion is limited to that virus.

In more than 150 virus trials (TABLE 2) the only virus-induced pathology has been fever and encephalitis. Severe encephalitis occurred in only one patient whose disease was not lymphoma or leukemia. In this same category of patients fever over 102° F. occurred in less than 30 per cent. In almost all patients there was a slight elevation of temperature concurrent with the period of viremia. In contrast, among 8 patients with lymphoma or leukemia, 5 had definite and 3 had mild encephalitis. This has deterred further work in patients with reticuloendothelial neoplasia in spite of the fact that the most dramatic tumor regressions occurred in this group.

Oncotropism (presence of virus within the tumor tissue) has been demonstrated in more than 80 per cent of patients infected with Egypt 101 virus in whom tumor tissue was accessible for study. In many of these there was evidence that the location of virus in the tumor was selective and due to propagation of virus in the cancer tissue, as judged by prolonged persistence of the virus in tumor or by higher titers of virus in tumor than in other tissues obtained simultaneously by biopsy or autopsy. Convincing objective evidence of tumor regression occurred in somewhat less than 10 per cent of patients and one half of these had lymphoma. A similar number had very transient or only suggestive evidence of virus-induced tumor regression. No patient with epidermoid carcinoma of any anatomic origin had convincing regression.

The clinical studies of Smith *et al.*[23] differed from ours in several respects. They treated cervix cancer using tissue culture preparations of adenoviruses (APC viruses) by direct inoculation into tumor masses or by regional intraarterial infusion. They often observed sloughing of tumor after treatment with live virus preparations and not after similar use of killed virus. There was no impressive therapeutic effect and no conclusive evidence that the viruses propagated in the tumor or elsewhere.

Similar clinical studies using the flulike ED virus intravenously or by direct inoculation into the cancer have been conducted by Nishioka and his co-workers in Japan. Local tumor regressions were observed following direct inoculation into tumors (personal communication from Tadashi Yamamoto, Institute of Infectious Diseases, Tokyo University, Tokyo, Japan, 1958).

TABLE 2

COMPARISON OF THREE PASSAGE TYPES OF EGYPT 101 VIRUS USED FOR EXPERIMENTAL TREATMENT OF PATIENTS WITH ADVANCED CANCER

Virus line	Total patients studied	Viremia*			Clinical severity**					Oncotropism†			Oncolysis‡		
		No	Minimal	Yes	□	■	●	⊕	♦	No	Yes	Selective	No	?	Yes
Epidermoid carcinoma only															
Fourth mouse or egg passage	16	0	5	11	4	8	1	0	1	3	5	5	14	1	0
HEp 2 tissue culture passage	17	4	4	9	10	2	3	0	0	2	1	4	15	1	0
HEp 3 tissue culture passage	18	2	1	14	5	12	0	0	0	1	3	1	14	1	0
All patients															
Fourth mouse or egg passage	84	4	7	73	21	36	12	3	6	6	36	14	56	10	6
HEp 2 tissue culture passage	30	6	9	15	15	8	3	0	0	6	7	5	24	4	1
HEp 3 tissue culture passage	51	3	1	47	18	22	7	0	0	3	8	7	45	2	0
All lines	165	13	17	135	54	66	22	3	6	15	51	26	125	16	7

* Viremia: Minimal means persisting 2 days or less after inoculation.

** Clinical severity: □, no reaction; ■, fever 1° to 3° F. above baseline; ●, fever greater than 3° F. above baseline but no other signs or symptoms due to virus; ⊕, suggestive or minimal evidence of encephalitis; ♦, definite encephalitis.

† Oncotropism: No, virus absent from tumor during viremia; Yes, virus in tumor during viremia; Selective, virus in tumor at least 48 hours later than in blood.

‡ Oncolysis: No, no objective tumor regression (subjective changes not considered); ?, very transient objective regression of tumor; Yes, definite objective evidence of tumor regression.

Our current clinical studies of viral oncolysis are directed toward three general problems: (1) the evaluation of oncolytic effects in man by means of a reproducible homotransplantable tumor, (2) the study of viral localization by fluorescein-labeled antibody technique, and (3) the evaluation of virus lines cultivated in serial passage in human cancer cell tissue cultures in hopes of making them more oncolytic.

Interest in a homotransplantable human tumor for evaluation of anticancer treatment arises from the truly enormous difficulty of objective evaluation of therapeutic responses in clinical cancer if the effects are anything less than spectacular. When one million or more tissue culture cells of the HEp 2 or HEp 3 cell lines (human epidermoid carcinomas) are implanted subcutaneously in patients with advanced cancer, they grow to form a measurable nodule. Rejection in these cancer patients usually begins 3 or 4 weeks after implantation and is sometimes delayed even longer.[24] There is great individual variation in maximum size and total duration of growth of the nodules, but the initial pattern of growth is sufficiently uniform that marked deviation from the expected picture might be accepted as evidence of extrinsic inhibitory effect. Inhibition of such homotransplants might then be used as an objective criterion of anticancer effect if treated and control groups are run simultaneously and in adequate numbers. No other system permits repeated study of a reproducible human cancer cell in human beings, but the clinical and technical problems are many.

When patients bearing these cancer homotransplants were treated with Egypt 101 virus, transplant growth was retarded as compared with untreated patients, suggesting that the virus impaired the growth of the transplants (FIGURE 1).

The fluorescein-labeled antibody technique of Coons[25] has been applied to 46 biopsy specimens of cancer tissue from 16 patients after treatment with Egypt 101 virus (TABLE 3) (this does not include previous studies done in collaboration with Noyes and Mellors[26] in which similar results were reported). Concurrent studies in mice demonstrated viremia in each of these patients and also demonstrated virus in 27 of the 39 tumor specimens collected between 3 and 14 days after virus inoculation. By the fluorescein-labeled antibody technique, virus antigen was definitely demonstrated in only 3 of these specimens (FIGURES 2, 3 and 4), and in only one (FIGURE 2) was the reaction strongly positive. The virus-containing cells can be identified with reasonable certainty as cancer cells, although the hemotoxylin-stained sections are from a different portion of the specimen. The brains of mice inoculated with and paralyzed by 10 of these same specimens were studied simultaneously by fluorescein-antibody technique and all were strongly positive (in all positive specimens the reaction was blocked by pretreatment of the section with unlabeled antibody and was not affected by pretreatment with normal human serum). These results demonstrate both

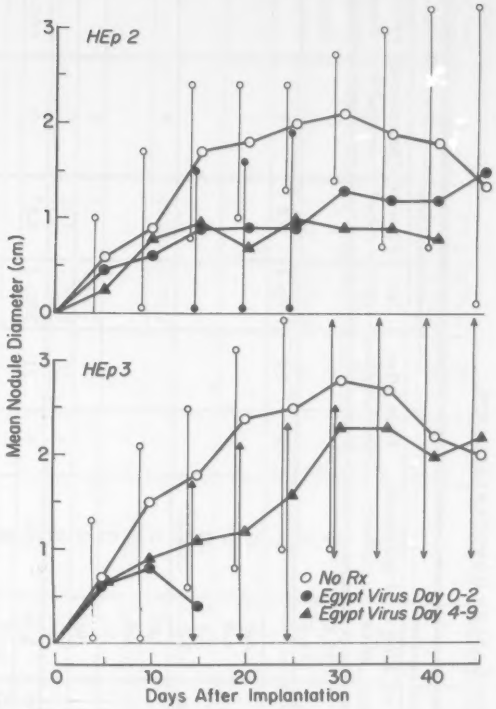

FIGURE 1. Apparent suppression of growth of cancer cell homotransplants in patients treated with Egypt 101 virus. Each curve is average of 7 to 11 patients except bottom HEp 3 curve that is for only 2 patients. The fine vertical lines ending in open circles or arrows indicate extreme range of nodule sizes in the control series. Ranges in the treated series (vertical lines terminated in solid symbols) are indicated only when maximum falls below the mean of the control group.

the adequacy of the technique and the identity of the virus.

This technique was also applied to biopsies of cancer cell homotransplants (TABLE 3). HEp 3 homotransplant biopsies from 8 patients 7 to 10 days after inoculation with Egypt 101 virus all contained virus detectable by mouse inoculation, but only 4 contained any viral antigen detectable by fluorescein-antibody and only 1 showed labeling of large numbers of the HEp 3 cells (FIGURE 5). HEp 2 homotransplants from 3 patients and single specimens of J-lll and Detroit 6 homotransplants were also studied. The only positive result was in a J-lll biopsy and this had only rare positive cells. Brains of mice inoculated with 6 of the homotransplant biopsies were all strongly positive for viral antigen by the antibody technique.

TABLE 3

COMPARISON OF MOUSE INOCULATION AND FLUORESCEIN-LABELED ANTIBODY TECHNIQUES FOR DETECTION OF EGYPT 101 VIRUS IN SPONTANEOUS CANCER AND CANCER HOMOTRANSPLANTS

Cancer diagnosis	Chart number	Viremia (days)	Spontaneous cancer				Homotransplants					Remarks
			Days after virus inoculation	Source of ca tissue	Titer in mice*	Fluorescein antibody*	Days after Virus	Days after Implant	Cell type	Titer in mice*	Fluorescein antibody*	
Melanoma	203703	4-5	6	node adrenal	⩾1.5 ⩾1.5†	⊕ □						FIGURE 2
Melanoma	203941	5-8					11	12	HEp 3	0.8	●	
Melanoma	149675	1-12	5 8 12 14	skin " " 4 metast.	4.8 4.8 1.5 1.3-2.2	□ □ □ □,□,□,□						
Lymphangio-sarcoma	220312	2-8	3 10 20	skin " "	1.5† 1.8 0	□ □ □						
Hemangiosa	202010	2-8	4	skin	0	□						
Sq Ca larynx	113529	2-6	6	skin	0	□						
Sq Ca bladder	220339	2-8	7	node	2.2†	□	7	21	HEp 3	3.5†	□	FIGURE 6
Sq Ca cervix	202539	3-6	5 9 14	perineum " "	⩾1.5 ⩾1.5 1.0	● □ □						FIGURE 4
Adeno breast	152484	2-6	11	skin	0.8†	■						

Adeno rectum	204464	4-6	1,2	as. fluid	0;0	□,□	9	14	HEp 3	0.5	□	
			5	" "	0.8	■	9	14	HEp 2	0	□	Implants
			7	" "	⩾1.5	□	9	14	Det 6	0	□	regressing
			9,12,14	" "	0;0;0	□,□,□						
Adeno rectum	204080	2-7	10	node	⩾3.5	□						
Adeno rectum	205590	5-10	22	rectus m.	0	■						
			28	2 metast.	0;0	□,□						
Adeno rectum	208409	2-7	7	as. fl.	1.0†	□	7	22	HEp 3	3.8†	■	
			7	node	1.8†	□	7	22	J-111	0.7†	■	
			12	primary	⩾1.5†	□						
			12	4 metast.	0;0;0;0	□,□,□,□						
Adeno rectum	230324	2-7	7	skin	0	□	7	21	HEp 3	3.8†	■	
			15	"	0	□						
			36	"		□						
Adeno rectum	208163	5-12	6	as. fluid	+	□						
			10	" "	+	□						
			17	" "	0	□						
Adeno colon	232720	4-14					7	21	HEp 3	3.5†	□	
							7	21		1.5†	□	
Adeno rectum	204550	4-7					9	10	HEp 2	1.5	□	
Adeno salivary	201930	2-10	13	arm	1.0	●						
			13	2 nodes	1.0,1.5	□,□						FIGURE 3
Adeno uterus	145143	2-9					8	12	HEp 3	⩾1.5	□	
Adeno uterus	202998	2-8					7	12	HEp 3	⩾1.5	⊕	FIGURE 5

*Mouse infectivity titer expressed as logarithm of reciprocal of the LD_{50} dilution on intracerebral inoculation in 16 to 18 gm. Swiss-Webster mice. Fluorescein-labeled antibody reactions: □, no specific fluorescence; ■, probable specific fluorescence in a few scattered cells; ●, specific fluorescence present but sparce or of low intensity; ⊕, specific fluorescence of high intensity in numerous but not all cells.

†Brain of paralyzed mouse strongly positive by fluorescein-labeled antibody technique.

Since virus titer (mouse intracerebrally LD_{50}) in these tissues was often less than $10^{-1.5}$ and seldom more than $10^{-4.0}$ (TABLE 3), this failure to demonstrate viral antigen in most of the known positive biopsy specimens may indicate insensitivity of the Fluorescein-labeled antibody technique. Sampling error must also be considered since those sections that are positive do not have a uniform distribution of the fluorescence, however it is hard to accept the concept that microtome sections could completely miss the virus-containing areas in a majority of specimens. A third and more attractive possibility is that the infectious virus in many of the cancer cells may exist in an antigenically incomplete form: either as naked nucleic acid or covered by a protein coat that lacks its definitive antigenic structure. Animal experiments designed to investigate these possibilities are currently being pursued.

Adaptation of Egypt 101 virus in the direction of greater oncolytic capacity for human cancer cells was attempted in collaboration with Alice Moore by serial passage of Egypt 101 virus in HEp 2 or HEp 3 tissue cultures. These two passaged lines were used, at various passage levels, for the treatment of patients with a variety of types of advanced cancers. Results can be compared with the previous studies using mouse or egg-passaged Egypt 101 virus.[19] They showed neither increased oncolytic effect against the patients' tumors nor significant change in virulence or infectivity as judged by clinical response or duration of viremia (TABLE 2). This table includes a separate analysis for epidermoid carcinoma because of the different composition of the three series according to cancer diagnosis and because the tissue culture cells with which adaptation was being attempted were of epidermoid carcinoma type. The lower frequency of oncolysis and oncotropism with the HEp 3 passage virus in the total series is attributable to this preferential choice of epidermoid cancer patients for this study and omission of the more responsive lymphomas. Similarly, the apparent decrease in neuropathogenicity in both tissue culture passaged lines is probably due to the avoidance of patients with lymphoma and leukemia.

Although these adaptation attempts failed to produce more frequent or more impressive oncolysis in the cancer patients, two items of suggestive evidence nurture the possibility that serial passage may have increased oncolytic capacity for the specific cell type in which it was cultivated. In the homograft studies (FIGURE 1) HEp 3-passaged virus was used and the apparent growth inhibition is more impressive for the HEp 3 implants than for the HEp 2. In the virus assays of these homotransplant biopsies (TABLE 3) the three patients who had both HEp 3 and other cell types had significantly more virus in the HEp 3 biopsies. Lack of comparable studies using HEp 2-passaged or mouse-passaged virus precludes any conclusions, but the impression is consistent with the observation in a heterologous transplant system that adaptation was effective only against the particular cell line in which the virus

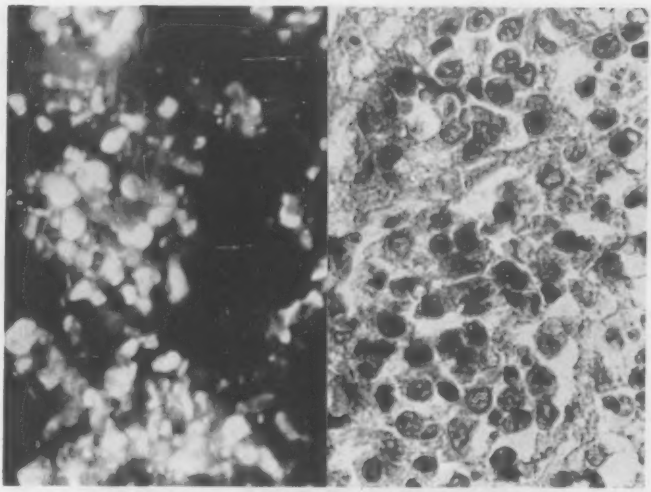

FIGURE 2. Autopsy specimen of mesenteric node metastasis of malignant melanoma 6 days after intramuscular inoculation of Egypt 101 virus. Case no. 203703. *(Left)* Frozen section stained by fluorescein-labeled antibody technique. White areas of fluorescence indicate localization of Egypt 101 virus, apparently in cancer cells. *(Right)* Hematoxylin-eosin stained section from nearby area of same specimen.

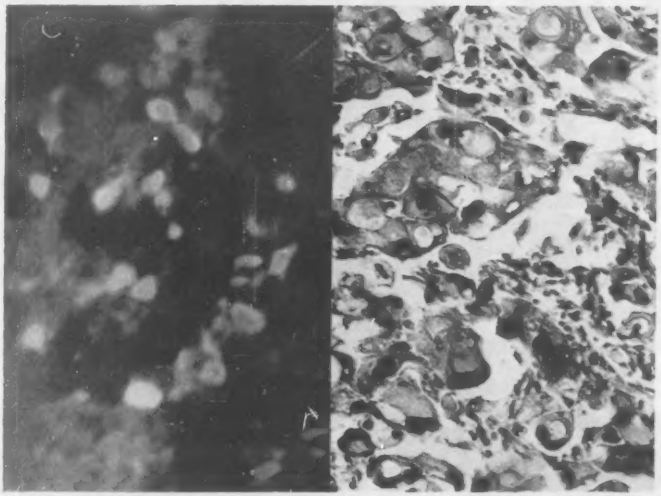

FIGURE 3. Biopsy of skin metastasis of salivary gland adenocarcinoma 13 days after intramuscular inoculation of Egypt 101 virus. Case no. 201930. Left and right as in FIGURE 2.

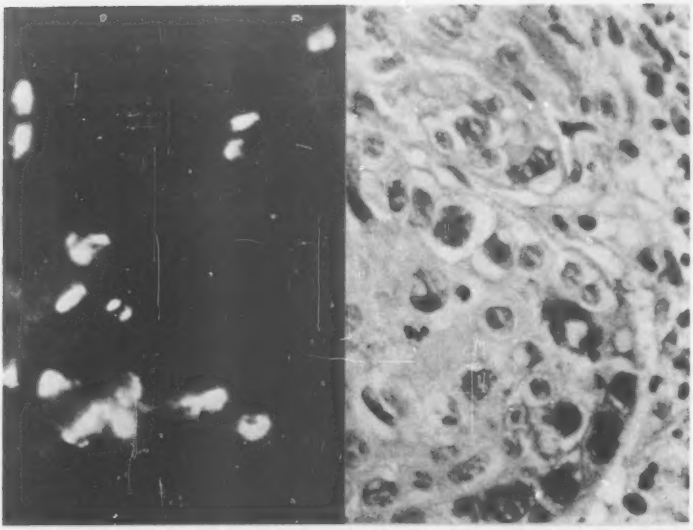

FIGURE 4. Biopsy of perineal recurrence of epidermoid cervix cancer 5 days after intramuscular inoculation of Egypt 101 virus. Case no. 202539. Left and right as in FIGURE 2.

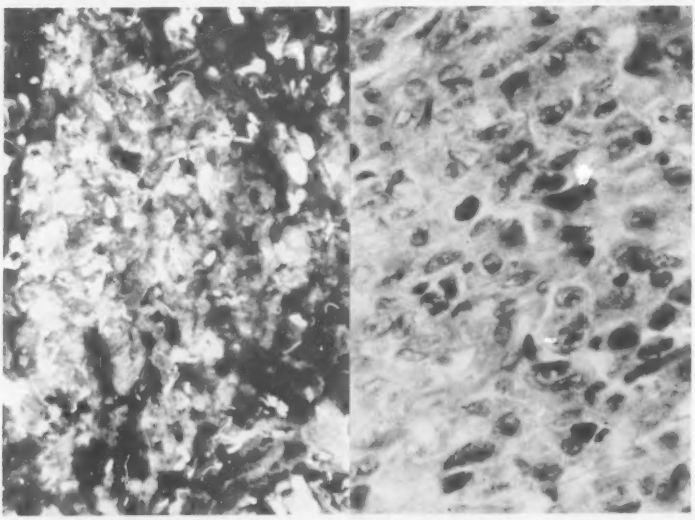

FIGURE 5. Biopsy of subcutaneous human cancer cell (HEp 3) homotransplant in patient with advanced cancer. 12 days after intramuscular inoculation of Egypt 101 virus. Case no. 202998. Left and right as in FIGURE 2.

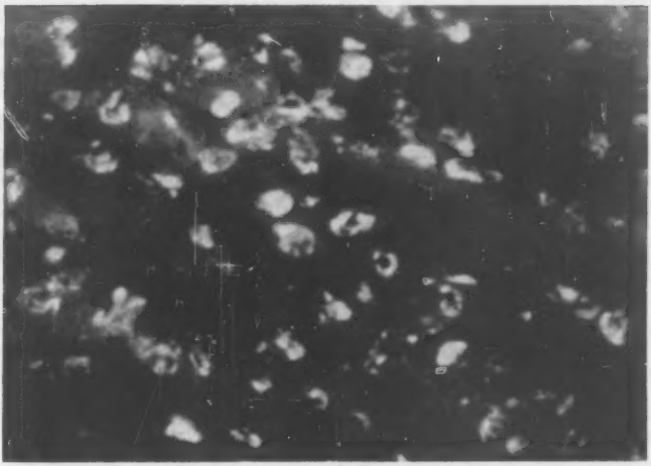

FIGURE 6. Frozen section of brain of mouse that became paralyzed 6 days after intracerebral inoculation of HEp 3 homotransplant biopsied from patient 220339 on day 7 after intramuscular inoculation of Egypt 101 virus. White areas of fluorescence indicate localization of virus within cytoplasm of neural cells. Fluorescent antibody studies on the HEp 3 tissue were negative.

was propagated.[14]

From this review it seems fair to conclude that viral oncolysis is a phenomenon of considerable research interest, that clinical application as attempted to date offers little hope for significant therapeutic response, but that the spontaneous cancer of patients and the transplantable cancers of experimental animals do show a basic similarity in response to oncolytic viruses. Since cure of animal tumors is achieved only by trial and error selection of a naturally effective virus of low virulence or by use of a virus specifically adapted to the tumor under study, it must be recognized that the clinical trials cannot be expected to yield therapeutic results until it is possible to select effective viruses for individual patients, to adapt viruses to the tumor of the individuals to be treated, or until empirical clinical trials turn up a virus of wide oncolytic activity against human cancer. Each of these approaches presents formidable technical problems.

In spite of this pessimistic outlook the continuing study of viral oncolysis has potential value in the search for systemic antineoplastic agents. The development of effective antiviral chemotherapy or the application of viral interference might permit the use of viruses that are now eliminated from our consideration because of high virulence for man. As knowledge is gained of the metabolic processes of virus growth and the mechanisms by which viruses cause cytolysis, it should

be possible to produce antimetabolites that reproduce these metabolic abnormalities. The highly specific nature of virus effects against different types of cells may be a tool with which the mechanisms of selective cell destruction can be demonstrated and reproduced. One approach to the production of such highly selective antimetabolites might be through the extraction and subtle alteration of viral nucleic acids and their subsequent application as antineoplastic agents. Each of these suggestions has the aspect of fantasy at the present time, and yet work along these general paths is being actively pursued in many laboratories throughout the world.

Acknowledgments

I am indebted to Roller Bailey, Giacomo Messore, and Louis Ortega of the Sloan-Kettering Institute for Cancer Research for their collaboration and assistance and for data they obtained by the flourescein-labeled antibody technique.

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FRENCH CONTRIBUTION TO SPACE RESEARCH*

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I propose to discuss the contribution that France has made to space research. If I were to compare this contribution to the spectacular achievements of the United States and of the Union of Soviet Socialist Republics, my enterprise would appear audacious. However, for such a task one must look back into the past and, since I have been in the field of research for the past 30 years, my undertaking will not be a difficult one.

Any spectacular accomplishment such as placing a satellite into orbit or sending a rocket to the moon is possible only if benefit is derived from previous efforts and experiences. Progress involves taking a succession of steps; one does not start afresh every time. I accordingly revert to the past: to about a century ago. The year 1959 was, in fact, a centenary: that of aerial photography. If today cloud photographs taken from a satellite or, even better, the transmission of pictures by television are matters of fact, it must be remembered that the first aerial photograph was obtained only after enormous difficulties had been surmounted. At that time balloons were filled with natural gas, and first attempts at aerial photography were unsuccessful. Vain efforts were being made then to photograph the Paris catacombs by artificial light, a type of illumination that proved unfeasible for photographical purposes in the United States as well. It was even concluded in that era that photography was a craft destined to be practiced only by sunlight. Thanks to the perseverance of inventors, however, the causes of these failures were finally discovered. In the case of photography by artificial light, the failure was due to a drop of potential in the cables carrying the current from the batteries to the lights and the insufficient sensitivity of the photographic plates. In aerial photography sulfur compounds emanating from the natural gas filling the balloons fogged the plates. It was Nadar (pen name of Felix Tournachon) who, in 1859, finally circumvented all difficulties and succeeded in taking the first aerial photograph near Paris. Since then the course followed by aerial photography is well known: reconnaissance photography during World War I, photogrammetry and, today, high-altitude cloud photography.

Discovery of the stratosphere also took place near Paris toward the end of the last century. It was at Trappes, not far from Versailles, that Leon Teisserenc de Bort, instead of going up in a balloon – a step initiated by Joseph M. Montgolfier in 1783 and repeated the next year by Pilatre de Rosier – sent up small balloons, as Joseph Louis Gay-Lussac had done in 1804, carrying temperature and pressure recorders. To these

*This paper, illustrated with slides and motion pictures, was presented at a Special Lecture of the Academy on May 3, 1960.

balloons de Bort attached parachutes, so that he could recover the instrument undamaged. In this way he found that the temperature decreased continuously up to a height of about 10 km. and then remained fairly constant; thus the isothermal region called the stratosphere was reached. It was believed at first that this region was calm and devoid of wind. Gases were now supposedly stratified in their decreasing order of density; hence the word stratosphere. The factual status was established only recently by means of rockets, microanalysis, and the mass spectrograph, which showed that it is only at 100 km. that a slight separation is perceptible.

The chief disadvantage in using sounding balloons is that they are recovered long after they fall, and the results recorded by the instruments they carry is therefore hardly utilizable; moreover, their equipment is often damaged by their impact with the earth or is destroyed by exposure to the weather. It was again at Trappes that, on March 6, 1927, Bureau and Idrac operated the first radiosonde: a small radio transmitter attached to a balloon carrying a device rotated by a vane that operated a manipulator signaling whether the balloon carrying it was ascending or descending. The first radiosonde reached a height of 14 km. It was thus shown that radio signals transmitted from a high altitude could be received satisfactorily on the ground. Today radio signals from the artificial satellite Pioneer V have been received from distances as great as several million kilometers. Gradually meteorological services have introduced radio sounding as a routine method of measurement. During the second Polar Year (1932 to 1933) systematic radio soundings were made by French stations at Scoresby Sound, Greenland, and at Tamanrasset, Algeria.

Simultaneously with investigations of the balloon technique, research on autopropulsion was being developed in France. Much attention was given to this problem. In J. Ferber's book, *From Crest to Crest, Town to Town and Continent to Continent* (1908), is found the following prediction: "To go up higher, and man will want to go higher, a different principle will have to be adopted. The principle of a rocket is evident; the jet engines follow therefrom. Man will be enclosed in a capsule in which respirable air will be fabricated. As a matter of fact, he will not go up on a flying machine but rather on a steerable projectile."

However, in this area of research the Frenchman who has earned fame is Robert Esnault-Pelterie. He was born in 1881 and died in 1957. In 1904 he constructed a biplane and, the next year, determined the resultant of the pressures on the experimentally effective surface with the aid of dynametric carriage. The first to construct a fuselage from metallic tubes, he later designed the fins and the rudder controlled by a single vertical lever, the steering stick, to ensure accurate maneuvering of the plane. This very simple but ingenious device establishes a simple kinetic relationship between pilot and plane. Oleopneumatic brakes that smoothed out the landing shocks and stopped the excessive bumping were used by

him in 1907 and, in the same year, he constructed the star-shaped engine with an odd number of cylinders. On November 15 of the same year he presented an astonishing communication, entitled "Considerations on a Substantial Reduction in the Weight of Engines" to the Société Francaise de Physique. To meet the requirements of the society he found it necessary to reduce the length of the article. However, the paper was rejected, and the author was forced to curtail it still further. The same paper was presented before the Astronomical Society in 1927 with a new title, "The Exploration of the Higher Atmosphere with Rockets and the Possibility of Interplanetary Voyages." The intellectual climate had now changed, however, and the paper was published intact in the *Bulletin de la Société Astronomique de France* (1928). The following is a brief summary of the content of that publication:

Chapter 1. Study of the motion of a rocket in vacuum; equations of motion; the most economical form; cylindrical rocket; conical rocket and exponential rocket; height and velocity at the end of combustion; escape altitudes and velocities; and efficiency.

Chapter 2. Study of the motion of a rocket in the air; equation of motion; equation of resistance of the air; ballistic coefficient; the most economical form; temperature of the compressed air in front of the rocket; and admissible accelerations.

Chapter 3. Use of rocket for the very high atmosphere or interplanetary voyages; firing on the moon; circumlunar trajectories; conditions determining the ejection velocity; what ejection velocities could be expected; and the probability of feasibility.

Chapter 4. Conditions necessary for the transportation of living beings, interplanetary vehicle, habitability; physiological reactions of the suppression of the gravitational field; steerability; conditions of feasibility; durations and velocities for journeys toward Mars and toward Venus.

Chapter 5. Scientific interest in visiting other worlds. Are they inhabited?

Some of the problems evoked above are of interest even today. Apart from the basic equations, the problem of re-entering the atmosphere is clearly defined, and the problem of the temperature of the vehicle and maintenance of an acceptable temperature inside it are still current. Esnault-Pelterie had clearly foreseen the possibilities brought forward by the liberation of energy that he called "intra-atomic."

The seeming contradictions between Esnault-Pelterie and R. H. Goddard, who was working at the same time at Princeton University, Princeton, N. J., are without importance, as the problem was treated from two entirely different points of view. Goddard wanted to send a projectile to the moon charged with aluminum powder and to witness the arrival by telescope, while Esnault-Pelterie was attempting to design a vehicle that could carry individuals to the upper atmosphere and bring them back to earth.

The enthusiastic spirit of a few people, including Alexandre Ananoff, and efforts of pioneers to develop jet propulsion with a view toward making astronautics an experimental science led to the organization of the Federation Astronautique Internationale in 1950. The astronomer Henri Mineur and I were the only members of the University of Paris who dared to take part in the founding of this organization.

Development of direct methods of exploration of the upper atmosphere, particularly by jet propulsion, have been due largely to parallel progress in understanding of the atmosphere by indirect methods. I recall a few examples of this. Before World War II, the ceiling of sounding balloons was approximately 30 km. To discover what was happening above this height, a bit of imagination along with astrophysical techniques was required. The existence of traces of a gas in the upper atmosphere was well-known: it is the atmospheric ozone. The reduced volume of the gas, that is, the volume that would accrue if it were separated from the rest of the atmosphere and brought down to standard conditions of temperature is 2 to 3 m. The concentration of this gas in the air is not homogenous. It shows a curious vertical distribution that was obtained by a spectograph attached to a sounding balloon. This work was done in Germany by E. Regener in 1934. Above the ceiling a spectral study of the light diffused by the zenith atmosphere at the time the sun is near the horizon must be made. This light diffusion is called the Götz effect, after P. Götz, the Swiss physicist who, while working at Spitzbergen, Norway, discovered it. At mean latitudes the maximum concentration is near the altitude of 25 km.

Before World War II I worked on the absorption coefficients of ozone in the laboratory and in the atmosphere. Near the ultraviolet limit of the solar spectrum there are absorption bands called Huggins bands that show maxima and minima. The maxima are not affected by temperature, while the minima are, hence a method of determining the mean temperature of the atmospheric ozone. As the vertical distributions of the ozone and temperature are known through the balloon sounding, events occurring above the ceiling of the balloon may be inferred from these differences and thus a significant increase in temperature may be demonstrated.

Making measurements in Swedish Lapland at 68° N. and also at middle latitudes, my associates and I found that, while at the middle latitudes there was no significant difference between the summer and winter temperatures of the ozone layer, there is a large variation in the polar regions. These results were confirmed at Ft. Churchill at 54° 46 min. N., 94° 10 min. W. by United States rockets during the International Geophysical Year (July 1957 to December 1958).

To give another example, the problem of atmospheric sodium may be considered. In 1929, Vesto Melvin Slipher had noticed a line at 5892 Å in the airglow that he could not identify. In 1937, Rene Bernard of the University of Lyon went to Trömso, Norway, in order to avoid the long

twilight periods while studying the twilight effect that J. Cabanes and Hubert Garrigue in France had just discovered on the red line of oxygen at 6300 Å. Rene Bernard found a similar effect on the yellow line. Two spectra taken with five minutes exposure time, one after the other, showed, in the first, an intense line; in the second, none. The resonance reminded Bernard of sodium. The identification was made by the classical means of the Alfred Perot and C. Fabry interferometer. The rings of the twilight sky corresponded well with those of the sodium flame. By a photometric study of the intensity of the sodium line made as the sun descended beneath the horizon, Bernard found that sodium was distributed in the atmosphere between the altitudes of 70 to 115 km. Finally, J. Bricard and Alfred Kastler deduced the temperature at this altitude by two different procedures: (1) by noting the absorption of the emission line across a cell containing the sodium vapor at different temperatures, and (2) by measuring the line width (Doppler effect). The temperature thus determined was 240° K., concurring with that found later for the same altitudes by use of rockets.

France, too, was becoming interested in rockets. It was in March 1949 that the Direction des Etudes et Fabrications d'Armement (Ministry of Supplies) had a rocket constructed to take a payload of 60 kg. up to 65 km. The construction was made by the Ballistic Research Laboratory of the army at Vernon, France. The first firing took place in the Sahara in 1952. Some improvements were made later and, on February 21, 1954, the rocket called Veronique reached a height of 135 km. On October 12 of the same year, a second rocket that attained a height of 90 km. carried equipment for studying the field of a radio transmitter as a function of height.

However, the budget allocated for the launching of rockets during the International Geophysical year was diverted from its objective by the French organizers of the I.G.Y. Consequently, it was not until March 1959 that three additional rockets were launched. One of them attained a height of 180 km. In February 1960, three more rockets were fired: one reached an altitude of 200 km. The latter was not impressive when compared to the United States' Pioneer V but, at the same time, it made feasible a penetrating study of the ultraviolet emission of the 3303 Å sodium line and demonstrated the perturbations in the green-line emission of oxygen due to the atoms of sodium. However, it is not necessary to launch rockets and satellites to accomplish useful work; vehicles launched by other countries may be utilized. By studying the Doppler effect of the signals transmitted by a satellite, it is possible to determine the time that the satellite passes at the minimum distance from the receiver. It is almost possible to deduce its velocity. If data from several stations are available, the orbit of the satellite can be determined completely, and it is for this reason that we have such an installation at our field station at Val Joyeux, France, about 30 km. from Paris. This station is adequately protected from local radio interference. On one

track of a magnetic tape the Doppler drift is recorded and, on the other, the time signals WWV are recorded from the clock of the observatory. Curves are then drawn and, although the signals are composed of a time-modulated and even discontinuous wave, it is finally possible to measure the frequency. The data are dispatched by cable to the Space Track Center at Cambridge, Mass., where they are utilized for determination of the orbit. They also serve us in the study of ionospheric disturbances.

It is not necessary to send up a satellite to do useful work: the transmitted wave alone can provide an interesting field of research; and it is in this way that more favored countries make a magnificent gift to others.

This paper has sketched briefly French activity in the area of space research. As a scientist, I have no desire selfishly to claim all credit for science; I therefore render due homage to our novelists. It was, in fact, J. H. Rosny who coined the word *astronaut*. It was Jules Verne, was it not who, despite some scientific errors, aroused in his readers a profound interest in this field, and was it not his genial imagination that showed technicians the path to follow.

CONFERENCES HELD

SECTION OF BIOLOGICAL AND MEDICAL SCIENCES

NEW DIURETICS AND ANTIHYPERTENSIVE AGENTS

Thursday, May 5 and
Friday, May 6, 1960

Conference Chairman: Arthur Grollman
University of Texas Southwestern Medical School
Dallas, Texas

THURSDAY, MAY 5, 1960

Session Chairman: Arthur Grollman
University of Texas Southwestern Medical School
Dallas, Texas

9:00 A.M. –
Greetings from the Academy – Robert L. Kroc, Chairman, Section of Biological and Medical Sciences, The New York Academy of Sciences, New York, N. Y.; Warner-Lambert Research Institute, Morris Plains, N. J.

"Present Concepts of the Mechanism of Urine Formation and of Diuretic Action" – Arthur Grollman, University of Texas Southwestern Medical School, Dallas, Texas.

"Animal Pharmacology of the Newer Diuretics – Benzothiadiazines, Spirolactones, Phthalimidine" – Barbara Rennick, Syracuse University, Syracuse, N. Y.

"Human Clinical Pharmacology of the Newer Diuretics – Benzothiadiazines and Phthalimidine" – John Moyer and Morton Fuchs, Hahnemann Medical School, Philadelphia, Pa.

"Comparative Studies of the Newer Diuretics" – Ralph Ford, Baylor University School of Medicine, Houston, Texas.

"Balance Factors and Mechanism of Action of Spironolactone" – Grant W. Liddle and William S. Coppage, Jr., Vanderbilt University, Nashville, Tenn.

"Effects of Benzothiadiazines on Serum and Total Body Electrolytes" – Peter Talso, Loyola University College of Medicine, Chicago, Ill.

Discussants: Arthur C. De Graff, New York University College of Medicine, New York, N. Y. and Norton Spritz, Cornell University Medical College, New York, N. Y.

"Evaluation of Diuretics" – Harry Gold, Cornell University Medical College, New York, N. Y.

Session Chairman: Augustus Gibson
Merck Sharpe & Dohme Research Laboratories
Rahway, N. J.

2:00 P.M. –
"Clinical Experiences with Some of the Newer Diuretics, Especially a Phthalimidine Derivative" – R. S. Mäch and R. Veyrat, University of Geneva, Geneva, Switzerland.

"Clinical Studies with Spirolactones" – Guy Hood, T. A. Farmer, S. R. Hill, and J. R. Pittman, University of Alabama, Birmingham, Ala.

General Discussion

"Use of Diuretics in the Pregnant Patient" – Martin Stone and Louis J. Salerno, New York Medical College, New York, N. Y.

"Use of Diuretics in the Treatment of Kidney Disease" – Jacques Genest, Hôtel Dieu, Montreal, Que., Canada.

"The Role of Diuretics in the Treatment of Liver Disease" – Robert Morrison, Lemuel Shattuck Hospital, Boston, Mass.

"The Use of the Newer Diuretics in the Treatment of Cardiac Disease" – John W. Keyes, Henry Ford Hospital, Detroit, Mich.

FRIDAY, MAY 6, 1960

Session Chairman: Walter M. Kirkendall
Cardiovascular Research Laboratories
State University of Iowa School of Medicine
Iowa City, Iowa

9:00 A.M. –
"Current Concepts of the Mechanisms of Hypertension" – Walter M. Kirkendall, Cardiovascular Research Laboratories, State University of Iowa School of Medicine, Iowa City, Iowa.

"Pathology of Hypertension" – Joseph E. Imbriglia, Hahnemann Medical College and Hospital, Philadelphia, Pa.

"Clinical Pharmacology of the Newer Antihypertensive Agents: Monamine Oxidase and Decarboxylase Inhibitors, Guanethidine and Bretylium Tosylate" – Louis Gillespie, National Heart Institute, Public Health Service, Bethesda, Md.

"Pharmacolcgical Consequences of the Selective Depletion of Catecholamines by Antihypertensive Agents" – Bernard Brodie, National Institutes of Health, Public Health Service, Bethesda, Md.

"Human Pharmacology of Guanethidine" – David W. Richardson, Medical College of Virginia, Richmond, Va.

"Human Pharmacology of Bretylium Tosylate" – F. James Conway, University of Michigan School of Medicine, Ann Arbor, Mich.

"The Effect of Chlorothiazide and Its Congeners on the Digital Circulation in Normotensive Subjects and in Patients with Essential Hypertension" – Milton Mendlowitz, Nosrat Naftchi, Stanley E. Gitlow, and Robert L. Wolf, Mount Sinai Hospital, New York, N. Y.

Session Chairman: Marion Bryant
New York University College of Medicine
New York, N. Y.

2:00 P.M. –
"The Role of Diuretics in the Management of Hypertension" – William Hollander, Boston University School of Medicine, Boston, Mass.

Discussant: Leo Schamroth, University of Maryland, Baltimore, Md.

"Clinical Experience with Guanethidine" – R. F. Maronde, University of Southern California, Los Angeles, Calif.

"Clinical Experience with Bretylium Tosylate" – Louis A. Soloff, Temple University Medical Center, Philadelphia, Pa.

"Newer Biochemical Approaches to the Treatment of Hypertension" – Albert Sjoerdsma, National Heart Institute, Public Health Service, Bethesda, Md.

Discussant: Marvin Moser, Montefiore Hospital, New York, N. Y.

PANEL DISCUSSION

PRESENT-DAY THERAPY OF HYPERTENSION

Moderator: Marion Bryant
New York University College of Medicine
New York, N. Y.

Panel: Albert A. Brust, University of Cincinnati, Cincinnati, Ohio.

Marion Bryant, New York University College of Medicine, New York, N. Y.

Louis C. Johnston, University of Illinois, Chicago, Ill.

Walter M. Kirkendall, Cardiovascular Research Laboratories, State University of Iowa School of Medicine, Iowa City, Iowa.

Concluding Remarks: Conference Chairman, Arthur Grollman, The University of Texas Southwestern Medical School, Dallas, Texas.

Robert L. Kroc
Chairman

Charles Noback
Vice-Chairman

DEUTERIUM ISOTOPE EFFECTS IN CHEMISTRY AND BIOLOGY

Thursday, May 12 and
Friday, May 13, 1960

Conference Co-Chairmen:

David Kritchevsky
The Wistar Institute of Anatomy and Biology
Philadelphia, Pa.

Joseph J. Katz
Argonne National Laboratory
Lemont, Ill.

THURSDAY, MAY 12, 1960

Session Chairman: William Spindel
Rutgers, The State University
Newark, N. J.

9:00 A.M. –

Greetings from the Academy – Charles Noback, Vice Chairman, Section of Biological and Medical Sciences, The New York Academy of Sciences, New York, N.Y.; College of Physicians & Surgeons, Columbia University, New York, N. Y.

Introductory Remarks – David Kritchevsky, The Wistar Institute of Anatomy and Biology, Philadelphia, Pa.

"Problems in the Quantitative Evaluation of Deuterium Isotope Effects" – Jacob Bigeleisen, Brookhaven National Laboratory, Upton, N. Y.

"Stereochemical and Kinetic Applications of Deuterium Isotope Effects" – Andrew Streitwieser, Jr., University of California, Berkeley, Calif.

"Secondary Isotope Effects in Chemical Reactions" – V. J. Shiner, Jr., Indiana University, Bloomington, Ind.

"Acid-Base Catalysis in D_2O–H_2O Mixtures" – F. A. Long, Cornell University, Ithaca, N. Y.

"Some Aspects of Deuterium Isotope Effects in Mechanisms Studies" – Clair J. Collins, Oak Ridge National Laboratory, Oak Ridge, Tenn.

Session Chairman: Joseph S. Gots
University of Pennsylvania School of Medicine
Philadelphia, Pa.

2:00 P.M. –

"The Effect of Deuterium Oxide on Certain Microorganisms" – Rosalie De Giovanni and Stephen Zamenhof, Columbia University, New York, N.Y.

"The Mutagenic Effect of D_2O on Bacteriophage T4" – Michael Konrad, University of California, Berkeley, Calif.

"The Effect of Deuterium Oxide on Virus-Host Interaction" – Lionel A. Manson, Richard I. Carp, V. Defendi, E. L. Rothstein, R. W. Hartzell, Jr., and David Kritchevsky, The Wistar Institute of Anatomy and Biology, Philadelphia, Pa.

"Cultivation of Microorganisms in Heavy Water" – Henry L. Crespi, S. M. Conrad, R. A. Uphouse, and J. J. Katz, Argonne National Laboratory, Lemont, Ill.

"Chloroplast Pigment and Photosynthesis in Deuterated Green Algae" – H. H. Strain, M. R. Thomas, H. L. Crespi, M. Blake, and J. J. Katz, Argonne National Laboratory, Lemont, Ill.

7:00 P.M.

"The History of the Development of the Use of Deuterium in Biochemistry" – David Rittenberg, Columbia University, New York, N. Y.

FRIDAY, MAY 13, 1960

Session Chairman: Sidney Weinhouse
Institute for Cancer Research
Philadelphia, Pa.

9:00 A.M. –

"The Use of Deuterium in the Study of the Sterochemical Relationships Within the Tricarboxylic Acid Cycle" – Sasha Englard, Albert Einstein College of Medicine, Yeshiva University, New York, N. Y.

"Hepatic Lipogenesis in D_2O-Fed Mice" – Joseph L. Rabinowitz, University of Pennsylvania and Veterans Administration Hospital, Philadelphia, Pa., Vittorio Defendi, John Langan, and David Kritchevsky, The Wistar Institute of Anatomy and Biology, Philadelphia, Pa.

"Physiological Effects of D_2O in Mammals" – John F. Thomson, Argonne National Laboratory, Lemont, Ill.

"Effects of Deuterium Oxide on Reproduction and Growth" – Edward L. Bennett, Ann Hughes, and Melvin Calvin, University of California, Berkeley, Calif.

"Deuterium and Reproductive Potential in Mice" – A. J. Finkel and D. Czajka, Argonne National Laboratory, Lemont, Ill.

"Coil-Helix Transformations in Deuterated Macromolecules" – H. A. Scheraga, Comell University, Ithaca, N. Y.

Session Chairman: Maxwell L. Eidinoff
Sloan-Kettering Institute for Cancer Research
New York, N. Y.

2:00 P.M.

"Effect of Deuterium Oxide on Bacterial Growth" – W. L. Lester, Jr., Suburban Cook County Tuberculosis Hospital-Sanitarium, Hinsdale, Ill.

"Effect of D_2O on the Growth of Ascites Tumors" – A. J. Finkel and D. Czajka, Argonne National Laboratory, Lemont, Ill.

"The Inhibition of Mitosis by Deuterium" – Paul R. Gross, New York University, New York, N. Y., and William Spindel, Rutgers, The State University, Newark, N. J.

"Cytochemical Studies on Deuterated Green Algae" – E. Flaumenhaft, Hiram College, Hiram, Ohio, and S. M. Conrad and J. J. Katz, Argonne National Laboratory, Lemont, Ill.

"Effect of D_2O on Cellular Components of Mammalian Cells Grown in Tissue Culture" – Edward L. Rothstein, R. W. Hartzell, Jr., L. A. Manson, and David Kritchevsky, The Wistar Institute of Anatomy and Biology, Philadelphia, Pa.

Closing Remarks – Joseph J. Katz, Argonne National Laboratory, Lemont, Ill.

Robert L. Kroc
Chairman

Charles Noback
Vice-Chairman

DIVISION OF MATHEMATICS

AND DIVISION OF PSYCHOLOGY

HUMAN DECISIONS IN COMPLEX SYSTEMS

Thursday, May 19 and
Friday, May 20, 1960

Conference Chairman: Warren S. McCulloch
Massachusetts Institute of Technology
Cambridge, Mass.

THURSDAY, MAY 19, 1960

9:00 A.M. –

Greetings from the Academy – Gregory Razran, Chairman, Division of Psychology, The New York Academy of Sciences, New York, N. Y., Queens College, Flushing, N. Y.

Introductory Remarks – Warren S. McCulloch, Research Laboratory of Electronics, Massachusetts Institute of Technology, Cambridge, Mass.

SURVEY OF THE PROBLEMS THAT MUST BE SOLVED IN FUTURE SYSTEMS

Session Chairman: Lawrence J. Fogel
Convair Aeronautics
San Diego, Calif.

"Human Decisions in Missile Systems" – John Mangelsdorf, Lockheed Aircraft Corporation, Sunnyvale, Calif.

"Human Decisions in Aircraft and Space Craft" – Alec Williams, Hughes Aircraft Company, Culver City, Calif.

"Human Decisions in Command Control Centers" – Marvin Adelson, Hughes Aircraft Company, Fullerton, Calif.

Discussant: John Lyman, University of California at Los Angeles, Westwood, Calif.

THEORETICAL APPROACHES TO THE DECISION-MAKING PROBLEM

Session Chairman: Marvin Adelson
Hughes Aircraft Company
Fullerton, Calif.

2:00 P.M. –

"Levels of Intelligence for Automata (Including Humans)" – Lawrence J.

Fogel, Convair Aeronautics, San Diego, Calif.

"Role of Memory in Detection Theory" – W. P. Tanner, University of Michigan, Ann Arbor, Mich.

"A Theoretical Model of Choice and Strategy Behavior" – Sidney Siegel, Pennsylvania State University, University Park, Pa.

"Components of Risk in Decision Making: Probability and Variance Preferences" – Clyde Coombs, University of Michigan, Ann Arbor, Mich.

Discussant: Julian Bigelow, Princeton University, Princeton, N. J.

FRIDAY, MAY 20, 1960

EMPIRICAL RESEARCH EVIDENCE REGARDING DECISION MAKING

Session Chairman: Heinz von Foerster
University of Illinois
Urbana, Ill.

9:00 A.M. –

"The Psychology of Memory" – J. C. R. Licklider, Bolt, Beranek and Newman, Cambridge, Mass.

"Stochastic Learning in Rats with Hypothalamic Implants" – Merrill Flood, Mental Health Research Institute, Ann Arbor, Mich.

"Decision Theory in Human Decision Making" – Philip L. Stocklin, Office of Naval Research, Washington, D. C.

"Some Problems of Vision Regarded with Respect to Linearity and Frequency of Response" – L. H. van der Tweel, Laboratory of Medical Physics, Amsterdam, Holland.

Discussant: Jerome Elkind, Bolt, Beranek and Newman, Cambridge, Mass.

THE RETICULAR FORMATION

Session Chairman: L. H. van der Tweel
Laboratory of Medical Physics
Amsterdam, Holland

2:00 P.M. –

"Anatomy of the Reticular Formation" – Arnold B. Scheibel and Madge Scheibel, University of California at Los Angeles, Los Angeles, Calif.

"Efferent Control of Afferent Responses" – R. Hernández-Peón, University of Mexico, Mexico, D. F., Mexico.

"Electric Activity of the Reticular Formation" – Vahe E. Amassian,

Albert Einstein College of Medicine, Yeshiva University, New York, N. Y.

Discussant: Warren S. McCulloch, Massachusetts Institute of Technology, Cambridge, Mass.

DIVISION OF MATHEMATICS

DIVISION OF PSYCHOLOGY

Gregory Razran
Chairman

Louis W. Max
Vice-Chairman

SECTION OF CHEMICAL SCIENCES

THERMODYNAMICS AND MECHANICS OF POLYMER SYSTEMS

Friday, May 27, 1960

Conference Chairman: Frederick R. Eirich
Institute of Polymer Research
Polytechnic Institute of Brooklyn
Brooklyn, N. Y.

FRIDAY, MAY 27, 1960

Session Chairman: A. Peterlin
University of Ljubljana
Ljubljana, Yugoslavia

9:00 A.M. –
Greetings from the Academy – Frederick R. Eirich, Institute of Polymer Research, Polytechnic Institute of Brooklyn, Brooklyn, N. Y.

Introductory Remarks – Frederick R. Eirich, Institute of Polymer Research, Polytechnic Institute of Brooklyn, Brooklyn, N. Y.

"Short and Long Range Interactions in the Isolated Macromolecule" – A. Peterlin, University of Ljubljana, Ljubljana, Yugoslavia.

"The Thermodynamics of Coiling-Type Polymers Investigated by Monte Carlo Techniques" – F. T. Wall, University of Illinois, Urbana, Ill.

"The Folding of Macromolecules" – E. W. Fischer, University of Mainz, Mainz, Germany.

Session Chairman: P. Flory
Mellon Institute
Washington, D. C.

2:00 P.M.
"Lattice Theory of Concentrated Polymer Solutions" – M. Kurata, Massachusetts Institute of Technology, Cambridge, Mass.

"Concentration Dependence of Polymer Dimensions" – M. Fixman, Mellon Institute, Washington, D. C.

"Theory of Non-Newtonian Viscosity in High Polymer Solutions" – B. H. Zimm, General Electric Company, Schenectady, N. Y.

"Some Recent Results in the Continuum Theory of Viscoelastic Fluids" – B. D. Coleman, Mellon Institute, Washington, D. C.

Frederick R. Eirich
Chairman

Everett S. Wallis
Vice-Chairman

DIVISION OF ANTHROPOLOGY

CULTURE, SOCIETY AND HEALTH

Wednesday, June 1
Thursday, June 2 and
Friday, June 3, 1960

Conference Co-Chairmen:

Dorothy L. Keur
Hunter College
New York, N. Y.
and
Vera Rubin
Research Institute for the Study of Man
New York, N. Y.

WEDNESDAY, JUNE 1, 1960

9:00 A.M. –
Greetings from the Academy – Dorothy L. Keur, Hunter College, New York, N. Y.; Chairman, Division of Anthropology, The New York Academy of Sciences, New York, N. Y.

SOCIOCULTURAL FACTORS IN CHRONIC ORGANIC DISEASE

Session Chairman: Leslie C. Dunn
Columbia University
New York, N. Y.

"The Ecology of Human Disease" – Jacques May, American Geographical Society, New York, N. Y.

Discussant: Howard Levene, Columbia University, New York, N. Y.

"Sociocultural Factors in Cancer in Hawaii" – Walter B. Quisenberry, Department of Health, Honolulu, Hawaii.

"Social Factors in the Epidemiology of Cancer at Various Sites" – Saxon Graham, Roswell Park Memorial Institute, Buffalo, N. Y.

"Problems in the Study of Coronary Artery Disease in Population Groups" – David M. Spain, Beth El Hospital, Brooklyn, N. Y.

"Socioeconomic Correlates of Hypertensive and Atherosclerotic Heart Disease" – Jeremiah Stamler, Board of Health, Chicago, Ill.

SOCIOCULTURAL FACTORS IN MENTAL ILLNESS AND IN PUBLIC HEALTH PROGRAMS

Session Chairman: Margaret Mead
American Museum of Natural History
New York, N. Y.

2:00 P.M. –

"Crosscultural Inquiry into the Symptomatology of Schizophrenia" – E. D. Wittkower, H. Ellenberger, J. Fried, and H. B. Murphy, McGill University, Montreal, Que., Canada.

"Cultural Stresses and Schizophrenogenesis in the Mothering-One in Puerto Rico" – Ramon Fernandez Marina, Puerto Rico Institute of Psychiatry, Bayamon, Puerto Rico.

"The Discrepancy Between Aspiration and Achievement in Mental Illness" – Robert J. Kleiner, Seymour Parker, and Hayward G. Taylor, Commonwealth Mental Health Center, Philadelphia, Pa.

"An Interdisciplinary Approach to Public Health on Navajo Indian Reservations: Medical Aspects" – Kurt Deuschle, Cornell University Medical College, New York, N. Y.

"An Interdisciplinary Approach to Public Health on Navajo Indian Reservations: Anthropological Aspects" – John Adair, Cornell University Medical College, New York, N. Y.

Discussant: Edward Wellin, American Public Health Association, New York, N. Y.

THURSDAY, JUNE 2, 1960

SOCIOCULTURAL FACTORS IN MENTAL ILLNESS AND IN PUBLIC HEALTH PROGRAMS

Session Chairman: Otto Klineberg
Columbia University
New York, N. Y.

9:00 A.M. –

"Native Endowment and Mental Health and Illness: A Crosscultural Perspective" – Edward Kennard, Veterans Administration Hospital, Perry Point, Md.

"Mental Illness and Rural Migrants to Cities: A Peruvian Case" William Mangin, Syracuse University, Syracuse, N. Y.

"Variations Between Negroes and Whites in Concepts of Mental Illness and its Treatment" – Fred W. Crawford, Glen W. Rollins, and Robert L.

Sutherland, Hogg Foundation for Mental Health, University of Texas, Austin, Texas.

"Culture Change and Health: A Conceptual Model and Research Design" – John Cassel, David Jenkins, and Ralph Patrick, University of North Carolina School of Public Health, Chapel Hill, N. C.

"Rural Healthways in New Mexico" – Sam Schulman, Department of Public Health, Santa Fe, N. Mex.

"Social Conditions of Fertility in a Rural Community in Transition in Central Italy" – Tullio Seppilli, University of Perugia, Perugia, Italy.

"Study of Fertility Differentials by Family Type in Trinidad" – George W. Roberts, Federation of the West Indies, Port of Spain, Trinidad, The West Indies, and Lloyd Braithwaite, University College of the West Indies, Mona, Jamaica, The West Indies.

SOCIOCULTURAL FACTORS IN CHRONIC ORGANIC DISEASE AND RESEARCH PERSPECTIVES IN MEDICINE AND SOCIAL SCIENCE

Session Chairman: Emerson Day
Memorial Center for Cancer and Allied Diseases
New York, N. Y.

2:00 P.M. –
"Socioeconomic Aspects of the Incidence of Cancer in Puerto Rico" – Victor A. Marcial, Puerto Rico Department of Health, San Juan, Puerto Rico.

"Epidemiology of Hypertension, with Particular Reference to Racial Susceptibility" – Marvin Moser, Montefiore Hospital, New York, N. Y.

"A Preliminary Report on the Relation of Sociocultural Factors to Hypertension Among the Zulu" – Norman Scotch, Washington State University, Pullman, Wash.

"Perspectives in Medico-Psychological Research with Regard to Grave Physical Illness" – Morton Bard, Sloan-Kettering Institute for Cancer Research, New York, N. Y.

PANEL DISCUSSION

RETROSPECT AND PROSPECT IN RESEARCH

Moderator: Thomas Gladwin
National Institute of Mental Health
Bethesda, Md.

Discussants: D. Carlton Gajdusek, National Institute of Neurological

Diseases and Blindness, Bethesda, Md.
Benjamin Pasamanick, Columbus Psychiatric Institute and Hospital, Columbus, Ohio.
Howard Schneider, The Rockefeller Institute, New York, N. Y.
Louis Verhoestraete, Pan American Health Organization, World Health Organization, Washington, D. C.
Donald Young, Russell Sage Foundation, New York, N. Y.

FRIDAY, JUNE 3, 1960

WORKSHOPS

9:00 A.M. –

I. Sociocultural Factors in Mental Illness

Chairman: Mottram Torre, World Federation for Mental Health New York, N. Y.

Discussants: Luis Feder, Asociación Psicoanalítica Mexicana, Mexico D.F., Mexico
Thomas S. Langner, Cornell Program in Social Psychiatry, New York, N. Y.
H. B. Murphy, McGill University, Montreal, Que., Canada.
Seymour Parker, Jefferson Medical College, Philadelphia, Pa.
Bertram Schaffner, William Alanson White Psychoanalytic Society, New York, N. Y.
Tullio Seppilli, University of Perugia, Perugia, Italy.

II. Sociocultural Factors in Chronic Organic Disease

Chairman: David Spain, Beth El Hospital, Brooklyn, N. Y.

Discussants: Emerson Day, Memorial Center for Cancer and Allied Diseases, New York, N. Y.
Walter B. Quisenberry, Hawaii Department of Health, Honolulu, Hawaii.
Norman Scotch, Washington State University, Pullman, Wash.
Jeremiah Stamler, Chicago Board of Health, Chicago, Ill.
Warren Winkelstein, Chronic Disease Research Institute, Buffalo, N. Y.
Ernest Wynder, Sloan-Kettering Institute for Cancer Research, New York, N. Y.

III. Sociocultural Factors in Fertility

Chairman: Marshall Balfour, The Rockefeller Foundation, New York, N. Y.

Discussants: William J. Gibbons, S.J., Fordham University, New York, N. Y.
José Janer, Puerto Rico Department of Health, San Juan, Puerto Rico.
Will Lissner, American Journal of Economics and Sociology, New York, N. Y.
Goran Ohlin, Columbia University, New York, N. Y.
George W. Roberts, Federation of the West Indies, Port of Spain, Trinidad, The West Indies.
G. William Skinner, East Asia Institute, Columbia University, New York, N. Y.

IV. Sociocultural Factors in Public Health

Chairman: Edward Wellin, American Public Health Association New York, N. Y.

Discussants: Lloyd Braithwaite, University College of the West Indies, Mona, Jamaica, The West Indies.
Robert Fink, North Carolina Board of Health, Raleigh, N. C.
John Hanlon, Department of Public Health, Philadelphia, Pa.
Ralph Patrick, University of North Carolina, Chapel Hill, N. C.
Irwin M. Rosenstock, United States Public Health Service, Washington, D. C.
Edward Suchman, New York City Board of Health, New York, N. Y.

2:00 P.M. –
Continuation of Workshops I, II, III and IV as scheduled during the forenoon.

DIVISION OF ANTHROPOLOGY

Dorothy L. Keur
Chairman

Ethel Boissevain Lesser
Vice-Chairman

NEW MEMBERS

Elected May 26, 1960

LIFE MEMBERSHIP

Archer, James E., Ph.D., Spectroscopy Solids, Director of Research, Pittsburgh Plate Glass Company, Pittsburgh, Pa.

De Somer, Pierre, M.D., Bacteriology and Virology. Professor, University Louvain, Louvain, Belgium.

Eibl, Hans, Ph.D. (Eng.), Immunology. Managing Director, Austrian Institute for Haemoderivatives, Vienna, Austria.

Evans, Ralph L., Ph.D., Chemistry. President, Evans Research and Development Corporation, New York, N. Y.

Prutton, Carl F., Ph.D., Chemistry and Chemical Engineering. Executive Vice President and Director, Food Machinery and Chemical Corporation, New York, N. Y.

Vogele, Ruth, M.D., Medicine. Private Practice, Utica, N. Y.

SUSTAINING MEMBERSHIP

Cahan, Amos, M.D., Immunology and Hematology. Director, Knickerbocker Blood Bank, Incorporated, New York, N. Y.

Davis, W. True, Biology. President, Anchor Serum Company, St. Joseph, Mo.

Dessauer, John H., D.Sc., Photography and Xerography. Executive Vice President in Charge of Research, Haloid Xerox Incorporated, Rochester, N. Y.

Keller, G., Essential Oils. President, Schimmel & Company, Incorporated, New York, N. Y.

Mulder, Jacob, M.D., Acute and Chronic Respiratory and Lung Disease. University Medical School, Leiden, The Netherlands.

Jokolic, Irvin H., M.D., Surgery. Adjunct, Department of Surgery, Albert Einstein Medical Center, Philadelphia, Pa.

ACTIVE MEMBERSHIP

Abarbanel, Abraham Robert, M.D., Physiology of Reproduction. Medical Director, Fertility Institute, Beverly Hills, Calif.

Abbott, Bernard C., Ph.D., Muscle Physiology. Associate Professor, Zoology, University of California, Los Angeles, Calif.

Abbott, Kenneth H., Neurosurgery. The Institute of Nervous Diseases, Los Angeles, Calif.

Abbott, Ursula K., Ph.D., Developmental Genetics. Assistant Professor, Poultry Husbandry, University of California, Davis, Calif.

Abildskov, J. A., M.D., Medicine. Associate Professor, Medicine, State University of New York, Syracuse, N. Y.

Abou-Taleb, Naim M., Ph.D., Engineering. Alexandria University, Alexandria, Egypt.

Abt, Arthur F., M.D., Biological Research. Chief, Radioisotope Service, Veterans Administration Center, Martinsburg, W. Va.

Accardo, Nick J., M.D., Orthopedic Surgery. Private Practice, New Orleans, La.

Ackart, Watson Boudinot, Ph.D., Food Bacteriology. Development Associate, Union Carbide Plastics Corporation, Bound Brook, N. J.

Ackermann, W. Wilbur, Ph.D., Epidemiology. Professor, School of Public Health, University of Michigan, Ann Arbor, Mich.

Acs, George, Ph.D., Biochemistry. Research Chemist, New York Psychology Institute, New York, N. Y.

Aggarwal, A. L., Ph.D., Physical Chemistry of Polymers. Head, Chemical Physics Research, The General Tire & Rubber Company, Akron, Ohio.

Aguiar, Adam Martin, Ph.D., Organic Chemistry of Phosphorus. Assistant Professor, Fairleigh Dickinson University, Rutherford, N. J.

Albisetti, Charles J., Jr., Ph.D., Organic Chemistry and Polymers. Manager, New Product Development, E. I. du Pont de Nemours & Company, Wilmington, Del.

Allred, Evan Leigh, Ph.D., Physical-Organic Chemistry. National Science Foundation Postdoctoral Fellow, University of Colorado, Boulder, Colo.

Alperin, Morton, Ph.D., Aeronautics and Mathematics. President, Space and Systems & Industrial Automation, Incorporated, Burbank, Calif.

Ames, Adelbert, III, M.D., Electrolyte Metabolism and Function in Brain. Research Associate, Harvard Medical School, Boston, Mass.

Ananthanarayan, R., Ph.D., Bacteriology. Professor and Head, Department of Bacteriology, Medical College, Trivandrum, Kerala, India.

Anderson, Charles Dean, Ph.D., Organic and Biological Chemistry. Assistant Professor, Pacific Lutheran College, Tacoma, Wash.

Anderson, Donald R., Ph.D., Radiation Effects. Radiobiologist, School of Aviation Medicine, Brooks Air Force Base, Texas.

Anderson, Jay O., Ph.D., Poultry Nutrition. Professor, Poultry Husbandry, Utah State University, Logan, Utah.

Anderson, Leigh C., Ph.D., Organic Chemistry. Professor, Chemistry, The University of Michigan, Ann Arbor, Mich.

Anglin, Walter M., M.D., Psychopharmacology. Clinical Research Staff, The Upjohn Company, Kalamazoo, Mich.

App, Alva A., Ph.D., Plant Biochemistry. President, Real Treat Mushroom Company, East Greenwich, Conn.

Argue, Charles William, D.Sc., General Biology. Dean of Science, University of New Brunswick, Fredericton, New Brunswick, Canada.

Armin, Kamaleddin, M.D., Medicine. Professor and Head, Department of Pathology, Teheran University, Teheran, Iran.

Armstrong, Frank Bradley, Ph.D., Biochemical Genetics. Genetics Foundation, University of Texas, Austin, Texas.

Armstrong, Leonard James, Ph.D., Organic Chemistry. President, Varney Chemical Corporation, Janesville, Wisc.

Arnowich, Beatrice, Ph.D., Chemistry. Chemist, Interchemical Corp., New York, N. Y.

Aronson, John N., Ph.D., Biochemistry and Chemistry. Assistant Professor, Chemistry, Arizona State University, Tempe, Ariz.

Arquette, Gordon J., Ph.D., Chemical Physics. Supervisor, Central Research Laboratory, Air Reduction, Incorporated, Murray Hill, N. J.

Arbandi, Charles, Ph.D., Pharmaceutical Chemistry. Associate Director, Research, Ethicon, Incorporated, Somerville, N. J.

Arth, Glen E., Ph.D., Organic Synthesis. Research Associate, Merck Sharpe & Dohme, Rahway, N. J.

Artiss, Kenneth L., M.D., Psychiatry. Chief, Department of Psychiatry, Walter Reed Army Institute of Research, Washington, D. C.

Artman, Joseph O., Ph.D., Microwave Paramagnetic Resonance. The Johns Hopkins University, Silver Spring, Md.

Ashford, Walter Rutledge, Ph.D., Scientific Administration. Research Associate,

Connaught Medical Research Laboratories, University of Toronto, Toronto, Ontario, Canada.

Atkinson, Daniel E., Ph.D., Biochemistry. Associate Professor, Chemistry, University of California, Los Angeles, Calif.

Auer, Peter L., Ph.D., Theoretical Physics. Physicist, General Electric Research Laboratory, Schenectady, N. Y.

Axelrod, Herbert R., Ph.D., Ichthyology. Publisher, T. F. H. Lithograph Corporation, Jersey City, N. J.

Babayan, V. K., B.A., Fats and Oils. Director, Research & Development, E. F. Drew & Company, Incorporated, Boonton, N. J.

Babbott, Elizabeth, Ph.D., Physiology. Instructor, Department of Zoology, Connecticut College, New London, Conn.

Babero, Bert B., Ph.D., Parasitology. Professor, Biology, Southern University, Baton Rouge, La.

Bagley, Edward Brownell, Ph.D., Rheology. Research Chemist, Canadian Industries, Limited, St. Lambert, Quebec, Canada.

Bailey, Frederick E., Jr., Ph.D., Physical Chemistry and High Polymers. Group Leader, Research Department, Union Carbide Chemicals Company, Charleston, Va.

Bentor, Yaacov K., Ph.D., Igneous Petrology. Director, Geological Survey of Israel, Jerusalem, Israel.

Bergel, Franz, Ph.D., Chemistry and Biochemistry. Professor, Chemistry, University of London, Chester Beatty Research Institute, London, England.

Berger, Eda, Ph.D., Psychology. Special Research Fellow, National Institute of Mental Health Fellow, Massachusetts Institute of Technology, Cambridge, Mass.

Bettinger, Harold H., D.D.S., Dentistry. Private Practice, New York, N. Y.

Bien, Ruth R., B.S., Chemistry. Chief Chemist, Good Housekeeping Bureau, New York, N. Y.

Bigelow, Charles Cross, Ph.D., Protein Chemistry. Assistant, Sloan-Kettering Institute, New York, N. Y.

Borer, A. F., B.S., Chemistry, Cereal Products. Operations Manager, Rahr Malting Company, Manitowoc, Wisc.

Borges, Wayne H., M.D., Pediatrics. Associate Professor, Pediatrics, University of Pittsburgh, Pittsburgh, Pa.

Bowden, Paul W., M.D., Clinical Research on New Drugs. Department of Clinical Research, A. H. Robins Company, Incorporated, Richmond, Va.

Bowen, Edmund John, D.Sc., Photochemistry. Fellow, University College, Oxford, England.

Bowen, Edward H., Jr., M.D., Clinical Pharmacology. Director, Clinical Research, Baxter Laboratories, Morton Grove, Ill.

Brenner, Don J., M.S., Microbiology. Senior Research Aide, Sloan-Kettering Institute for Cancer Research, New York, N. Y.

Bright, Willard M., Ph.D., Chemistry. Vice President, Lever Brothers Company, Edgewater, N. J.

Brown, Charles H., M.D., Gastroenterology. Head, Department of Gastroenterology, Cleveland Clinic, Cleveland, Ohio.

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